A STUDY OF RELATIONSHIP BETWEEN SPATIAL EGOCENTRISM & CONSERVATIC OF LENGTH & AREA IN DELHI SCHOOL CHILDREN

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CHAPTER - I

INTRODUCTION

Piaget's theory of cognitive development has recently accelerated inquiry into the way in which children store and represent information about their world. His study (1953) of intellectual development of his own children starting from their birth helped him to understand how qualitative and quantitative changes take place in cognitive field.

While psychometricians were interested in the correct answers on tests, for Piaget Children's incorrect answers were much more interesting. During his experiments he found that similar wrong answers were given by the children of about the same age and that the same kind of wrong answers were given by the children of certain age range. His interest was to discover the different methods of thinking used by the children at different age levels. On the basis of his intensive studies of children he concluded that cognitive development of the child takes place in a sequential manner. He identified four broad stages:

I. Sensori - Motor Stage (0-2 years*)

At this stage the infant's learning is mainly directed towards co-ordinating his action and perception into

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*The age range which Piaget has given for different stage is not fixed. It varies from culture to culture. But the sequence of stages is fixed and invariant in the cognitive development.

organized schemata of action or sensori - motor schemata. He starts getting aware of the permanence of objects. He cannot differentiate between himself and his action, between "me" and "not me" during this periods.

II. Preoperational Stage (2-7 years)

This stage is characterized by the development of representational processes such as language, play, dream, imitation etc. But they may be said to be in primitive stage. At this stage egocentricity is one of the characteristics of all these processes. To the pre-operational child everything revolves round him. He sees or thinks in terms of his own point of view. He lacks decentration and reversibility in his thought processes i.e. he can focus his attention only on one aspect of the situation at a time and he cannot reverse the direction of his thought.

III. Concrete Operational Stage (7-11 years)

At this stage such logical operations as classification, symmetry, seriation, one to one correspondence, etc. develop. But the use of these operations are limited to actual objects or to those imaginations which are easy. He can reason logically with respect to concrete things. The child can use logic or reasoning to some extent when the objects are visible i.e. he can think in relation to

concrete objects. Abstract reasoning as such is beyond his reach. He is less egocentric at this stage than was at the earlier stage but cannot get over his egocentrism completely. For the egocentrism of this stage Elkind (1967) has used, the term 'concrete operational egocentrism*'.

IV. Formal Operational Stage (11 years & above)

At this stage the child can make plans of actions based on hypothesis which he proceeds to test. Within his environment he seeks all explanations and general laws. He can use formal logic and abstract reasoning. At this stage he slowly gets rid of his egocentrism and his thought processes become operational. So this is the stage when the child starts to show those cognitive behaviours which are qualitatively similar to that of adult.

EGOCENTRISM

Egocentrism is one of the characteristics of child's thinking in which Piaget has tried to find the key to psychological phenomena characteristic of child's mind. According to Piaget within the individual, a major portion of developmental energies are invested into the process of overcoming his egocentrism. Piaget assumes that egocentricity

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*The characteristic of this type of egocentrism has been discussed later in this chapter.

is a general stage through which all children pass. Egocentrism is unavoidable and must be overcome before the child can reach more mature level of cognitive functioning. Piaget tells:

> "In the psychology of intellect it is this egocentrism that seems to us to explain the logic and the causality peculiar to the child, his difficulty in handling relations and in forming objective series etc. From the social and moral point of view, it is this egocentrism that explains why, though he is so absorbed in others that he confirms to examples and commands received from without, the child yet introduces into every piece of collective behavior an irreducible element of individual interpretation and unconscious deformation".
>
> (Piaget 1932, P. 399)

> "... However dependent he may be on the surrounding intellectual influence, the young child assimilates them in his own. He reduces them to his point of view and therefore distorts them without realising it, simply because he cannot yet distinguish his point of view from that of others through failure to co-ordinate or "group" the points of view. Thus, both on the social and on the physical plane he is egocentric through ignorance of his own subjectivity".
>
> (Piaget 1950, P. 160)

So in the Piagetian theory, historic or ontogenetic evolution begins in a state of relative egocentrism.

Meaning of the Term of Egocentrism

In daily speech egocentrism means referring everything back to oneself i.e. to conscious self or "having to do with one's wants and needs" (Cameron 1967, p. 465). According to Warren (1934), the term egocentrism refers

to a subject who is "disposed to dwell on oneself and to view every situation from a personal angle". But Piaget has always "insisted on its epistemological meaning," and not "on its popular or moral meaning'" (Piaget 1962 P. 118). According to him the term egocentrism is not only limited to child's conscious thoughts. It does not carry the meaning of selfishness or overtly keen regard for oneself or of the frequent use of "I" and "me". Piaget quoted Zezzo who tells that a child does not speak "for himself but "according to himself, that is, on the basis of his limitation as well as his possibilities" (quoted by Piaget & Inhelder, 1969, P. 122).

In describing the meaning of egocentrism Piaget takes help of Freudian theory. In psychoanalysis there are two ways of thinking: one is "logical thought" and the other is "autistic thought". The first way of thinking is communicable, social and guided by the need for adapting oneself to others. Autistic way of thinking is incommunicable, confused, undirected and indifferent to truth. The prominent characteristic of autistic though is that it is unconscious of itself and mostly guided by affective factors. According to Piaget

> "the child's way of thinking occupies a place situated exactly between 'autistic' and social. We have therefore given it the name of egocentric, which indicates that this type of thought is still autistic in its structure but that its interests tend not merely towards

> organic or 'ludistic' satisfaction as in pure autism but towards intellectual adaptation as in adult thought."
>
> (Piaget, 1928, P. 205)

Piaget assumes that egocentrism may be considered as a mode of "spontaneous apperception" which consists of a kind of primary adjustment in the "absence of all intellectual relativity and any relational system of reference " (Piaget 1926, P. 270). The small child finds himself in a physical and a social world about which he knows nothing. He cannot differentiate between "me" and "not me". The social reactions and linguistic expressions which are beyond the understanding of the child are always susceptible to be assimilated from the narrow and limited angle of his own particular point of view. Since his knowledge about the world is derived from his own actions, so he thinks in a subjective manner, where everything has reference to his own self. Relations based on early stage of reasoning are always relations between the self and the objects (including human beings). For Piaget (1928) the discovery of law is always dependent on the possibility of using relations in all directions and of finding the reciprocal counterpart to every relation. But as it is stated, egocentric child judges everything from his own point of view and so he may be called to be involved in transductive reasoning. Transductive reasoning is defined by Piaget as a "combination of relations woven between the organism and

the external world by action (the movements of the organism), but without consciousness of its own processes on the part of this action, and consequently without conscious realization of its own existence on the part of thought" (Piaget, 1928, P. 197). The child having this type of reasoning process takes his own point of view as obsolute. He fails to establish reciprocity of thought between himself and the external world, on which objectivity of though is based. This idea is conveyed by the definition of Piaget who defines egocentrism as "the inability to differentiate between one's own point of view and the other people's or between one's own activity and changes in the object " (Piaget, 1926, P. 267).

The another important point about the egocentrism is that it is not a conscious phenomena. As Piaget puts it, "Egocentrism is thus neither a conscious phenomena (egocentrism when self conscious is no ego-centrism) nor a phenomena of social behaviour (behaviour is an indirect manifestation of ego-centrism, but does not constitute it) but a kind of systematic and unconscious illusion, an illusions of perspectives " (Piaget 1926, P. 268). A similar idea can be found in the definition of Church. According to him "egocentrism simply means embeddedness in one's own point of view, without any awareness that one has a point of view rather than an instantaneous, unlimited, exhaustive, and infallible grasp of reality as it actually is." (Church, 1961, P. 26). On the basis of these definitions it can be stated that the child is

egocentric without being aware of it. The reason is that egocentric thought lies in between autistic and social thoughts. So it has certain degrees of unconsciousness, a prominant characteristic of autistic thought. While questioning the children, Piaget found that children of certain age groups appeared to be unconscious of their own reasoning processes or they were incapable of "immediate introspection or retrospection " (Piaget, 1928, P. 210). For example while inquiring about the development of the concept of life Piaget noticed that children of lower age groups, say, of 4 or 5 years, regarded all self moving bodies as alive but they were not able to explain why they thought so. The main reason behind this unconsciousness of his own reasoning process was that when he was involved in thinking only for himself he has no need to be aware of the mechanism of his reasoning process. He has confidence in his own ideas. It is only under the pressure of diverse experiences, opinions and arguments that his firm beliefs, are shaken and he acquires the habit of watching his own thought processes.

Egocentrism and Centration

According to Piaget one of the predominant characteristics of an egocentric child is that he is unable to take any point of view except his own. Researches of Piaget (1950) and Feffer (1959, 1970) have identified a single characteristic - centration that underlies all kinds of egocentrism. A description of this characteristic will be

helpful in understanding the concept of egocentrism and adult way of thinking.

Within Piagetian theory centration has been defined as the fixation upon one aspect of changing relationship to the exclusion of other aspects. Centration is a single aspect of the situation that prevents the child from taking into account features which could balance and compensate for the distorting or biasing effect. Centration on a single aspect of the situation is responsible for the deformation in objective reality.

Piaget believes that egocentrism prevents the child "from adopting the point of view of several different objects simultaneously or more generally, of objects themselves " (Piaget 1928, P. 219). So egocentric way of thinking lacks the ability of decentration. According to logiceans, there are two types of judgement. The first type of judgement is called "predicative judgement" in which a single point of view is taken into consideration. The second type of judgement is called "relational judgement", which involves the simultaneous awareness of two or more points of view. In the judgement of relation, the reciprocal relations between two or more individual or objects change according to the points of view of each individual, this is what the egocentric way of thinking lacks. According to Piaget, distortion is inherent in centring upon a given aspect of perceptual field. An

egocentric child does not analyse the contents of his perception , but weighs it down with a load of previously acquired and ill-digested material. "This material is based on "immediate, sectional, and personal point of view" (Piaget 1928, P. 248-249)·Judgement of an egocentric child is influenced by the superficial or peripheral aspects of reality. In imagination he lacks adequate representation of the objects and is unable to shift his attention from one position to another. Centring prevents the child from taking any other point of view other than the one he has at the moment i.e. his own point of view. Reasoning of an egocentric child is distorted because information from other phases or entire configuration is not brought into the conceptualization.

For the child who is unable to simultaneous decentering, most probable strategy to focus his attention would be that which is simple and requires least effort on his part. The next strategy would be adopted on the basis of two factors. The first factor is the salience of stimulus which attracts his attention. The second factor is subjectivity. He may adopt a different strategy because of a "lack of satisfaction about always using the same solution when it is not accompanied by certainty "(Piaget, 1960, P. 103).

The egocentric child fails to grasp the reciprocity existing between different points of view. It is beyond his reach to "combine one action to another action and it cannot

be carried out in two directions in so far as it is centrally adjusted "(Piaget 1926, P. 279). For Piaget the beginning of egocentrism clearly expresses the irreverisibility of action and thought. Because he centres on the static aspect of the situation he cannot reverse the direction of his thought which requires of him consideration of two points of view at a time.

An egocentric Child lacks the reversibility of thought. In reversible thought the child's cognitive organization is able "to travel along a cognitive route (pursue a series of reasoning, follow a series of transformations in a display, etc.) and then reverse direction, in thought to find again an unchanged point of departure (the beginning premise, the original state of the display, etc.)" (Flavell, 1963. P. 159). Thought processes require structure that permits mobility. Progressive interiorization of a scheme goes hand in hand with an increase in mobility which refers to a scheme's range of potential application within the totality of available schemata. This mobility is only possible when the child can attend to two or more aspects of a situation at a time. To sum up it can be said that intellectual decentrations set free the child from egocentricity.

Egocentrism and the Process of Equilibirium

Conceptual conflict or disequilibrium is fundamental to intellectual development in Piaget's theory. Piaget

borrowed the term of equilibrium from physics to refer to a state of balance or harmony between at least two elements which have previously been in a state of disequilibrium. Equilibrium internally structures the developing intelligence. In a particular situation when equilibrium is disturbed, it is re-established either due to assimilation or accommodation. Assimilation occurs when the input information is modified to fit the subjective interpretation of individual. Accommodation occurs when the existing mental structures are modified to fit objective reality. Through equilibrium the organization of reciprocal assimilation and accommodation are maintained and internal and external imbalances are compensated.

In egocentrism assimilation and accommodation are mentally antagonistic or opposed in their functioning. To gain the state of equilibrium assimilation and accommodation are required to collaborate instead of pulling in different directions.

The general Psychoanalytic position holds that egocentrism is characterized by an initial state of undifferentiation and narcissism in the infant, this is a state of fusion between the self and the environment. According to Freud (1965) if all needs and wishes of a child are fully gratified he would exist in a constant state of

equilibrium and thus would remain at this undifferentiated and therefore egocentric level.

As it is stated the disequilibrium is very important to move the child from one stage of intellectual development to another stage. Piaget joins Clapréde* in believing that difference between objects creates disadaptation and this disadaptation causes consciousness. As the child seeks to adapt himself with others, he comes into contact with opposing points of view, he becomes aware of the contradiction which occurs as a results of his use of inappropriate problem solving strategies. In order to resolve this conflict he organizes his thinking that leads him toward objectivity. For Piaget egocentrism changes to sociocentrism as the child comes into contacts with his peers and adults.

CLASSIFICATION OF EGOCENTRISM

Egocentrism can be classified in a number of ways. Broadly speaking egocentrism can be classified in two ways:

1. Classification based on Piaget's developmental stage(Inhld. Piaget 1958, Elkind 1967).
2. Classification based on the cognitive area to which egocentrism is related.

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*referred by Piaget (1928, PP. 212-219)

I. Classification Based on Piagetian Developmental Stages

Egocentrism takes different forms as it proceeds from primitive level to mature level of intellectual functioning. Inhelder & Piaget (1958) and Elkind (1967a) have identified three types of egocentrism corresponding to three types of developmental stage of intelligence.

i. Sensori - Motor Egocentrism

Egocentrism occuring at sensorimotor stage have been called 'Sensorimotor egocentrism' (Elkind 1967a,p. 1026). Sensori - moter stage is the earliest stage of cognitive development. During this period child begins to acquire the concept of permanance of objects, but he lacks completely a differentiation between himself and his actions. The child deals with objects as long as it is present before his eyes. The egocentrism of this stage reflects in the child's inability to differentiate between the object and the "sense impression occasioned by it" (Elkind 1967a,P. 1026).

By the end of this stage the internal representation of objects starts developing. This is one of the earliest symbolic functions that helps the child in releasing him from 'Sensori - motor egocentrism'.

ii. Preoperational Egocentrism

Although the development of symbolic behaviour sets free the child from 'Sensori - motor egocentrism, again this

is the main area (symbolic representation through language) where egocentrism occurs. Development of the language is the main achievement at the pre-operational stage. This is adversely affected by the egocentrism. The egocentrism of this stage has been called "Pre-operational egocentrism" (Elkind 1967a, P. 1026). Due to this type of egocentrism the child is not able to adapt his speech according to the needs of his listener (Piaget 1932). When a child is asked to describe any event he uses many idenfinite terms and leaves out the important information. This is due to his egocentrism. From his point of view words carry much more meaning than they actually do. He is not aware whether others are understanding his speech or not. He talks according to his own point of view .

iii. Concrete Operational Egocentrism

Egocentrism of the concrete operational stage has been termed as "concrete operational egocentrism" (Elkind 1967a, P. 1027). At this stage the child starts to acquire the concepts of classes, relations, quantities and conservation. The child's egocentrism is manifested in these areas when he is unable to differentiate accurately between his "mental products (resulting from his newly acquired operations), and perceptual givens" (Elkind 1967a, P. 1027). When he constructs a hypothesis, he assumes that this is a product which has been imposed by the external data. He does not think that this is the result of his own thought processes.

If his hypothesis is challenged the child will again interpret that data to be congruent with that hypothesis. Due to his egocentrism he gives priority to the product of his own thought rather than the product of the environmental stimulation. At the end of this stage the child starts to discover the arbitrariness of his mental products and learns to separate them from the external environmental stimulations.

2. Classification of Egocentrism Based on The Cognitive Area To Which It Is Related

In Piaget's writings terms like 'cognitive egocentrism' (1962, P. 5), intellectual egocentrism (1926, P. 273) 'Social egocentrism' (1926, P. 272), 'Verbal egocentrism' (1926, P. 270) and 'Spatial egocentrism' (1956, P. 218) etc. have been used. But he has made no attempt to describe clearly which of these terms are synonymous and which are different. Rubin (1973) have classified egocentrism into four types:

i. Cognitive Egocentrism

The term 'cognitive egocentrism' was used by Piaget (1962, P. 5) to describe the child's inability to infer other people's experiences such as thoughts, desires, attitudes, plans, emotions etc. This type of egocentrism is intrinsically involved in the form of intra - personal as well as interpersonal cognitive functions.

ii. Role - Taking Egocentrism

This term has been used by Rubin (1973). This egocentrism reflects the child's inability to predict another

person's role attributes in a cognitive situation. Role taking egocentrism does not refer to the child's inability to predict the immediate perception (visual perception) of others which is different from his own. But this is the inability to make inference of those role attributes which are not directly perceptible (which are inside the persons).

iii. Communictive Egocentrism

Piaget in his book 'Language and Thought of the Child' has mentioned a term 'Verbal egocentrism'. This term may be taken as synonymous with communicative egocentrism. Piaget has described two types of speech. The first type of speech is called "egocentric speech' and the second type of speech is called as "Socialized speech". According to Piaget"Child of 4-7 years centres in his own point of view and is unable to take into account his auditor's view points and needs. He speaks in his own manner without concerning whether his communicative information is grasped by the listener. Three types of egocentric speech have been identified by Piaget (1926). The first type of speech is repetitive speech, in which words and syllables are repeated for the pleasure of talking. The child does not bother weather he is being listened or not. The second type of egocentric speech is called monologue speech, in which the child talks to himself as one thinks aloud. The presence of a listener is not needed for this type of speech also. The

third type of egocentric speech is termed as "duel or collective monologue". The child talks to others without taking into account the listener's point of view. He does not care whether he is being understood.

The second type (mature type)of speech - the socialized speech covers the primary aims of communication. The talk is adapted to the needs of listener.

iv. Spatial Egocentrism

This term has been used by Piaget (1956, P. 218) to describe the egocentrism related to space. This is the child's inability to reproduce the visual perspective of other persons. He is not able to assume that appearances of the object are the function of the spatial positions from which they are viewed. Due to egocentrism he is not able to put himself cognitively in the place of another person and imagine how an object or an array of objects look from that position. He lacks decentration in his imagination. He also lacks representation of himself and of his own displacement as seeing from outside. A spatially egocentric child locates everything in relation to himself when he is asked to reproduce the visual perspective different from his own. He cannot locate himself in the space. No matter what the visual perspective he has to reproduce he always coordinates the whole complex of relationship among objects in relation to his own present position.

There is reason to assume that all kinds of egocentrism are related to one another. For example cognitive egocentrism covers all kinds of egocentrism, but all cognitive egocentrism cannot be considered as role-taking, communicative or spatial egocentrism. However the question needs further investigation.

EGOCENTRISM AND COGNITIVE DEVELOPMENT

Egocentrism as a characteristic of mental and behavioural life is the salient aspect of early childhood. It occupies a central position in Piaget's theory. According to Flavell* et al:

> "Piaget suggests that egocentrism taints the child's efforts in virtually all spheres of activity. For example, his primitive conceptions about the physical world (among which are animistic beliefs) are thought to be an egocentric product (Flavell, 1963, Ch. 8). In the same way, egocentrism gives rise to curious attitudes about moral-ethical phenomena (ibid.). And finally, it casts its shadow over the spectrum of interpersonal activities which require role taking ability, including, of course, verbal communication"
>
> (Flavell et al. 1968, P. 17)

In the development of child's conception of the world, the child's tendency of animism results due to this egocentrism. Because of this tendency the child treats physical objects such as clouds, stars etc. as having the attributes of biological-psychological entities. The child lacks

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*Flavell J.H. is considered as one of the leading interpreter of Piagetian theory in the English speaking world.

differentiation between his self and the world. He feels himself to be alive and also regards physical objects as alive.

According to Piaget (1932) in the development of moral judgement an egocentric stage occurs from about 4 to 7 years. A child's thinking at this stage cannot assume the points of view of others, so he cannot understand the value of rules, which protect the interests of others. At this stage rules for the child are external things, which do not effectively transform his behaviour. Moral judgement of the young child is authoritarian. Rules are imposed from outside and should be obeyed.

Judgement and reasoning of the child are also distorted due to the centration on a single point of view - his own or immediate point of view. According to Piaget (1928) child's egocentrism tends to deform the relational judgment of the child. He avoids relations and reduce the relational judgment to simpler and absolute form of predicative judgment (as has been mentioned earlier in this chapter). For the child "left" and "right" hands are the names of the hands. The left and right hands of a person sitting to the opposite of the child are always viewed from the child's own point of view. In the case of brother - sister relationship he always considers his brother and sister from his own point of view and unable to imagine himself as their brother. He also

cannot think that his brother and sister are among themselves also brother and sister. To understand such a relation requires consideration of two points of view simultaneously - his own and his siblings. He unconsciously extends his own immediate point of view to all possible points of view. Tendency of syncretism and juxtaposition in child's reasoning can also be said to be the resultant outcome of egocentrism, which lead the child to assimilate all things into some subjective schemata. He imposes his arbitrary schemata upon the world of external objects.

Egocentrism also hampers child's effort to communicate. The child does not bother to know to whom he is speaking nor whether he is being listened. As it is said earlier in connection with communicative egocentrism, the egocentric child is insensitive to the needs of the listener. To him a words carry much more meaning than it actually does. So according to Piaget egocentrism in early stage of life is responsible for all the "logical peculiarities" in child (Piaget, 1928 P. 255).

CONCEPT OF CONSERVATION

Conservation plays a central role in the theorization and experimentation in the developmental psychology of Jean Piaget. This concept is also one of the most explored area in the field of cognitive growth. Bruner consider conserva-

tion as "a powerful idea not only in science but also in the conduct of everyday life. We need not to pause over its generality in mathematics, in which it plays such a crucial role in the idea of function, or in physics, in which the conservation theorems are so powerful an extension of the common-sense version. Indeed, much of the common sense and all of science would be impossible without conservation" (Bruner 1966. P. 183).

In Piaget's words "Conservation is a necessary condition for all rational activity" (Piaget, 1952, P. 3).

According to Flavell "conservation may be defined as the cognition that certain properties (quantity, number length, etc.) reamin invariant (are conserved) in the face of certain transformations (displacing objects, and parts in space, sectioning an object into pieces - changing shape etc.) " (Flavell, 1963, P. 245).

The same idea has been conveyed by Vernon and Kingsley. According to them "conservation is a term used to describe the situation when an attribute (e.g. weight) of an object remains invariant through certain changes in other attributes of that object " (Vernon & Kingsley, 1968, P. 195-196).

Piaget assumes that conservation has a natural development in all mankind provided they live in the environment in which they have the opportunity to interact

with such physical objects and materials such as water, mud, sand sticks etc.

Development of conservation is not all or none phenomena. It is gradually mastered. The development of conservation of different concepts according to Piaget follow a certain order of appearance. First conservation of mass, then conservation of weight and then conservation of volume occur. Researchers in this area have found different age groups conserving the concept of mass weight and volume. According to Piaget conservation of mass develops at the age of 7 to 8 years, conservation of weight develops at the age of 9-10 years and conservation of volume appears at the age of 11-12 years. Regarding exact age range for development of different kind of conservation there is no agreement amongst the researchers. Also it has been found that there may be cultural differences. There are other aspects of conservation such as number distance length and area. Conservation of number develops simultaneously or just after the development of the conservation of mass. According to Piaget, conservation of area appears at the same time as that of distance and length (Piaget 1960, P. 285). The conservation of these aspects develop after development of conservation of weight (Piaget 1960). Thus conservation of different aspects does not appear at the same time. The reason behind this is that conservation of different aspects

require some different pre-requisite operations. With the development of conservation of one concept the child acquires some operations which help him in the acquisition of conservation of other concepts. According to Piaget (1952) the most general pre-requisite operations for development of conservation are multiple classification, multiple relationality, reversibility, seriation, etc.

Stages of The Development of Conservation

According to Piaget development of the idea of conservation whatever may be the concept (length, area, number, mass, volume etc.) takes place in three stages:

(i) Stage of non-conservation

At this stage the child gives justification by perceptually centring on a single irrelevant dimension of the object. The child lacks co-ordination between the quantitative relations involved in the perceptual relationship. According to a non-conserver every one of the initial attributes of an object is lost in the face of transformation. Non conservation occurs due to the child's inability to decenter. Information is not brought into conceptualization. He simply focuses his attention upon successive stages or configurations of a display rather than the transformation by which one configuration is changed into another.

(ii) Transitive Stage

The child of this stage attempts to co-ordinate the perceptual relations involved. But he is not fully successful. He gives slightly correct answer when the variation is not much but changes his idea of conservation when more variations are added through transformation.

(iii) Stage of Conservation

This is the stage when the child is gradually able to conserve a quantity irrespective of the number and nature of the changes made. The perceptual relationship have now become operational.

NEED OF THE STUDY

Whether egocentrism has anything to do with development of conservation is still an open question. As discussed previously studies of Feffer (1959, 1970) and Piaget (1950) have shown that a single factor - the inability to decenter underlies all forms of egocentrism. The inability to decenter has also been thought to underlie the child's failure to conserve (Looft 1972, Piaget, 1928). A non-conserver child seems to be confined to the surface aspects of the situation and he assimilates only those superficial features that dominate his perceptual field. All other stated characteristic of non-conserver (discussed earlier in this Chapter) are also the characteristics of an egocentric child. No study has so far been made in which

relationship between egocentrism and conservation has been properly investigated. Rubin (1973a) has done a factor analytic study but his purpose was to identify a factor or construct commonly underlying all forms of egocentrism and conservation (the study has been discussed in the next chapter). So an empirical investigation in this direction will be worthwhile.

STATEMENT OF THE PROBLEM

The following problem was taken by the researcher for investigation: 'A STUDY OF RELATIONSHIP BETWEEN SPATIAL EGOCENTRISM AND CONSERVATION OF LENGTH AND AREA IN DELHI SCHOOL CHILDREN'.

OBJECTIVES OF THE STUDY

The major aims of the study are:

I. To find out the relationship between spatial egocentrism and conservation of length.

II. To find out the relationship between spatial egocentrism and conservation of area.

The other aims of the study are:

I. (a) To construct suitable tests for the assessment of conservation of length and conservation of area on the basis of Piagetian tasks.

  (b) To construct or adopt a test of spatial egocentrism.

II. To see whether conservation of length and conservation of area are related.

III. To find out the relationship between intelligence and (a) conservation of length, (b) conservation of area.

IV. To find out the relationship between intelligence and spatial egocentrism.

DELIMITATIONS OF THE STUDY

Following would be some of the delimitations of the study:-

1. Only one form of egocentrism namely the spatial egocentrism would be taken into consideration.
2. The study would covers conservation of two concepts only: Length and area.
3. Only one age group (10 or 11 years) would be covered by this study (see Chapter III for details).
4. The study would be confined to only one Sex (Boys were taken).
5. The study would cover only one type of school - Municipal Corporation Primary Boys Schools.
6. This study would be undertaken in Municipal Corporation Primary Boys Schools of South New Delhi Zone.

DEFINITIONS OF THE TERMS USED

Spatial Egocentrism: In this study the term spatial egocentrism will mean the subject's inability to reproduce another person's visual perspective of a display viewed

from a positions different from the subject's own.

Conservation: The definition of conservation given by Flavell would be used as a definition of the term. According to Flavell "conservation may be defined as the cognition that certain properties (quantity, number, length etc.) remain invariant (are conserved) in the face of certain transformations (displacing objects and parts in space, sectioning an object into pieces. Changing shape etc.)."

(Flavell 1963 P. 245)

HYPOTHESES:

The following are the null hypotheses formulated and taken up for testing on the basis of date would be collected for the study.

1. There is no relationship between spatial egocentrism and conservation of length.
2. There is no relationship between spatial egocentrism and conservation of area.
3. Conservation of length and conservation of area are not related.
4. Intelligence has no relationship with conservation of length.
5. Intelligence has no relationship with conservation of area.
6. Intelligence has no relationship with spatial egocentrism.

CHAPTER - II

REVIEW OF RELATED STUDIES

The area of researches inspired by Piaget is very vast. Specially Piaget's studies on conservation has been a popular issue of further inquiry for numerous researchers in different parts of the world. But in comparision to, conservation researches on egocentrism seem to be very limited. Most of the researches so far done on egocentrism are concentrated on its measurement aspect. Only a few researchers have paid their attention to study its nature, and its relations to other variables. In order to have a clear picture, review of the studies on egocentrism and conservation, is being done in the following sections:

Section (A) - Studies on Egocentrism

(a) Piaget's original studies on egocentrism

(b) Post Piagetian studies on measurement of egocentrism.

(c) Post Piagetian studies on egocentrism in relation to other variables.

Section (B) - Studies on Conservation

(a) Piaget's original studies on conservation

(b) Post Piagetian studies on measurement of conservation.

(c) Post Piagetian studies on conservation in relation to other variables.

SECTION - A
STUDIES ON EGOCENTRISM

(a) PIAGET'S ORIGINAL STUDIES ON EGOCENTRISM

PIAGET (1926) - Piaget's first study on egocentrism was done in relation to children's language development. This study was purely an observational study. He examined the spontaneous, verbalisation of a number of children ranging in age from 4 to 7 years. It was found that a considerable percentage of their utterances were of egocentric nature. This egocentric speech was classified by Piaget into three: repititive speech, monologue speech and dual or collective monologue (A description of these types has already been given in Chapter I).

PIAGET (1926) - Piaget has done another study which was conducted to examine the development of communication in children. The sample consisted of 50 children (20 children aged 6-7 years and 30 aged 7 to 8 years). Each subject was given some information (e.g. a story) by the experimenter and then was instructed to relate it to the second child of the same age group. This second child then had to communicate back to the experimenter what he had understood out of the information conveyed by the first child. On the basis of this investigation Piaget concluded that children aged 6 to 7 years failed to take into account the listener's

point of view. According to him when the child is 7 to 8 years old (or older), he would start developing social communicative behavior (Socialized speech).

PIAGET (1928) - In another study of Piaget, 240 children (100 of them were girls) between the ages of 4-12 years were asked 12 questions. 6 questions were asked in respect to the concept of brother and sister and other 6 questions in relation to the concepts of right and left. As far as the development of the concept of brother and sister is concerned, Piaget found that it was not till the age of 10 or so that children were able to say simultaneously that he himself was the brother of his Siblings, as well as his Siblings were his brother or sister. Before this age most of the subject gave egocentric responses refusing themselves to be the brother or sister of their own Siblings.

On the basis of the findings of this study Piaget identified three stages in the development of the concepts of right and left. In the first stage (5 - 8 years) left and right are considered from the child's own point of view. In the second stage (8-11 years) left and right can be considered from the stand point of the other person. In the third stage (11 - 12 years) left and right can also be considered from the point of view of the things themselves.

PIAGET (1956) - In his later studies the development of role taking or perspective ability (the reverse of

egocentrism) was studied by using the tasks which were non-verbal. In one of these studies Piaget & Inhelder (1956) have devised a scale model of three mountains and showed these models individually to 100 children ranging in age from 4 to 12 years. A doll was placed on different positions around the model of three mountains. Three methods were used to assess the subject's ability to predict the appearance of mountains from the positions other than the subject's own: (i) subject was given three pieces of card board shaped like the mountain and was told to arrange them so as to reproduce the doll's view point; (ii) a series of pictures representing various view points were shown to the subjects and then he was asked to select one of them which was correct for a given position of the doll; (iii) subject was shown a picture of a particular view of the model and was asked to place the doll in an appropriate position to watch the view given in the picture. On the basis of this study Piaget and Inhelder have identified four stages in the development of coordination of perspective.

First stage (4-6 years) - Piaget has labelled it as 'Substage II A' (Piaget 1956, P. 213). At this stage the child completely organise the whole complex of objects in terms of his own perspective. He is not able to liberate himself from egocentric illusions.

Second stage (6-7 years) - This stage was termed by Piaget as 'Substage II B' (Piaget 1956 P. 223). At this stage the child realizes that the view of objects in a display is relative to the positions from which they are seen but he is still ignorant that the internal relations of objects in a co-ordinate system also change with the position from which they are viewed.

Third stage (7-9 years) - Piaget called this stage as 'Substage III A' (Piaget 1956, P. 233). A child at this stages achieves what he lacked in the earliest stage except the coordination of left and right relationships. This type of relationship seems to be too difficult for him to comprehend.

Fourth stage (above 9 years) - This stage as labelled by Piaget 'Substage III B' (Piaget 1956 P. 239) is the stage when the child has developed completely all the operations required to coordinate a perspectives. He can co-ordinate left - right, before - behind and above or below relations in a co-ordinated system and can perceive the perspective different from his own.

The egocentrism manifested while performing tasks like three mountains task has been termed as "Spatial egocentrism" (Piaget & Inhelder 1956, P. 218).

(b) POST PIAGETIAN STUDIES ON MEASUREMENT OF EGOCENTRISM

Piatet's three mountain task has initiated a number of researches. All the researches done on the measurement aspect of egocentrism are mainly oriented towards examining the effect of task complexity or experimental design on the role-taking skills. Some of the studies have supported Piaget's findings while others have not. A brief review of these studies will be given in the following paragraphs.

FLAVELL et al. (1968) - Flavell et al. have designed 16 tasks to study the development of role taking and communication in early childhood (3-6 years of age) and middle childhood (7 to 11 years of age). In the development of their tools they have followed psychometric model though not in the strict sense. For example, for some of the tasks they have calculated correlation coefficient as measures of interscorer agreement. These researchers have also arranged the scores obtained by the subjects grade-wise to see the accent of score with the increasing age. Some of the tasks (e.g. tasks, IIIA, IIIC, IIIF) were revised as they did not indicate developmental changes with age. All the 16 tasks can be classified into two categories as far as the aims were concerned. (i) tasks dealing subject's ability to predict other's cognitive responses and (ii) tasks dealing subject's ability to predict other's perceptual or visual impressions. Here only one type of tasks, which are related with spatial egocentrism will be discussed.

In one group of tasks, Flavell et al. have attempted to assess subject's ability to predict the visual appearance of an object or an array of objects from positions different from that of the subject. One of the examples of this type of task is Task IC[*] (Flavell et al. 1968,P. 55-70). This task was modelled after three mountains task of Piaget and Inhelder (1956) and was presented to 160 subjects who were studying in grades 2 to 8 and 11. There were four displays in this taske arranged in increasing order of difficulty. The result showed that the youngest subjects had little difficulty in reproducing the experimenter's view on the easiest display and only very few of the 17 year old subjects could reconstruct the most difficult configuration correctly as seen from the position of the experimenter. Flavell et al. found that the younger children were in fact largely aware of what the task demanded. But this awareness could be considered only a necessary and not a sufficient factor. Failure to cope with the demands of this type of tasks, was explained by the researchers mainly on the basis of age & complaxity of tasks. Like Piaget and Inhelder (1956), Flavell et al. also found that left - right dimension was more difficult than front-back dimension in reproducing the views of displays as seen

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[*] The same task is used to study the spatial egocentrism in the present research. The description of tasks and procedure have been given in Chapter III.

by another observer from a position different from the subject's own. In this study they did not report any thing about Piaget's egocentric stages because the subjects of Flavell et al. were older (above 6 years) than the subjects of Piaget & Inhelder (1956). Rubin (1973a, 1974) has used the tasks developed by Flavell et al. for studying spatial egocentrism of children.

SHANTZ et al. (1971) - Shantz et al. have devised a method to assess the spatial egocentrism through expectancy violation. 48 preschool subjects were presented with a situation in which under a "trick" condition the spatial movement of the subjects did not result in appropriate transformation of view of a visual display. If the child had some expectancy of a different or specific view of that display, after moving to another position if he sees the same view, he would show some signs of surprise, preplexity, or amusement. At least half of the subjects between 3 to 5 years of age expressed by their verbal statements, that they did not find what they had expected only fourteen of these subjects were able to tell that discripancy between what they expected and what they saw was caused by turning the objects.

BORKE(1971) - Borke conducted a study on 200 children between the ages of 3 to 8 years. The subjects were individually presented with a series of short stories (Some kinds of emotions were depicted in these stories). Each story had

a picture of a child with a blank face. After going through the story the subject had to complete the picture of that child by selecting any of the four faces of emotions shown in the start of the experiment that seemed to match with emotions illustrated by that particular story. On the basis of this study Bork concluded that children as young as three years of age are quite aware of other people's feelings even though they may not be as skilful as older children in communicating this awareness. He supported Piaget's observation that social sensitivity increases with age but disagreed with Piaget's view that children upto the age of 7 years are primarily egocentric.

CHANDLER & GREENSPAN (1972) - Chandler and Greenspan contradicted Borke's conclusion. They challenged the legitimacy of Borke's procedure. Borke has employed a methodology using a set of conceptual skills sharply different from those used by the Geneva group. Moreover Borke has relied too heavily on verbal reports. Within the context of Piagetian theory (1956) role taking skill implies a great deal more than predicting how another person might feels in a different situation. The results of the study of Chandler & Greenspan indicated that errors in the process of social decentration persist well into middle childhood and occur despite the child's apparent skill to predict correctly the affective responses of others.

GARNER & PLANT (1972) - Garner & Plant conducted an experiment to study some aspects of Piaget's three mountains task. 225 subjects aged 6-8 years were divided into two groups. All the subjects were individually shown various pictures representing the different views of three mountains as seen from different vantage points. Subjects of the first group were asked to select the picture representing their own views first then to find out the picture of other views as seen from positions different from their own. (This method was identical to the method of Piaget & Inhelder 1956). The second group of subjects were asked to select the picture representing the view from a position other than his own and then the picture representing their own views. On the basis of this study it was found that higher level of "egocentric responses" (selecting the own view for other vantage points) were siven more often by the first group of subjects. So these researchers concluded that egocentrism in Piaget's three mountains task was more a function of experimental design than children's thought because in Piaget & Inhelder's (1956) experiments egocentrism responses have been cued by experimental procedure; the subject was first asked to select a picture depicting his own view and then that of another person sitting at a positions other than the subject own. This finding appears to be important but needs confirmation.

FISHBEIN et al. (1972) - Two experiments were conducted by Fishbein et al. to investigate the effect of the nature of perspective tasks on the performance of preschool, first grade and third grade children. In his first experiment 120 middle class boys and girls ranging in age from 3 years 5 months to 9 years and 5 months were taken. Three conditions were examined; the effect of number of objects on performance (one toy and three toys); the effect of number of photographs shown to the subjects (four photographs and eight photographs) and the effect of the type of responses required (pointing to a toy or an array of toys or turning the toy or toys). In the pointing task a toy (and then three toys) was shown to the subject and he was asked to point a picture representing the view of experimenter seated at the place different from subject's own. While in the turning task the toys were displayed one at a time or three at a time on a revolving tray and the subject was asked to turn the revolving tray so that the experimenter could see the view as it would be seen from one of the four positions (side, opposite, etc.). In this experiment it was found that task complexity had no effect on the percentage of egocentric errors. The findings of this study also support Piaget's view that accuracy on such task increases with age.

The second experiment was conducted by the same researchers (1972) on 64 Kindergarten (mean age 5.7 years) and 64 second grade (mean age 7.7 years). The stimulus

materials and procedure were identical as in the first experiment. On the turning task in this experiment experimenter pointed a photograph showing a view and asked the child to turn the tray so that Experimenter could see the same view as shown in photograph. Experimenter repeated the same procedure after sitting in four positions one after the another. In this study it was found that older children made fewer incorrect responses thus supporting Piaget's view. The researchers argued that occurance of egocentric response in older children may be due to the fact that as children mature the older modes of thought coexist with more recent mode of thinking.

COX (1975) - Cox has conducted an experiment to study whether the performance of children in Piaget's three mountains task would be better if the observer was a person instead of doll.* Two matched groups whose mean age was 6.10 years were taken. In one group, the subjects were asked to select the picture representing the view of the model of three mountains as they were seen by a doll from a different vantage point. The subjects of the other group had to select the pictures representing the views of the model of three mountains as they were seen by the experimenter from a different position. It was found that in the second group the mean correct response was significantly

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*In Piaget & Inhelder's experiment of three mountains task the subjects had to reproduce the perspective as it is seen by a doll.

lower than the first group. From this study Cox suggests that egocentrism is not necessarily a fundamental characteristics of the young child's thinking but may result from or it may be increased by the experimental procedures.

COX (1977) - Another study done by Cox was concerned with relative difficulty of the different positions occupied by the other observer. 180 subjects aged 6 to 8 years and 10 years were individually shown an array of objects in which the views from different experimental positions were objectively equal in difficulty level. From this study it was found that representing the 90° and 270° views were easier than the 180°view.

WALKER et al. (1977) - Walker et al. conducted a study on a sample of 68 children between the ages of 4 to 7 years. These subjects were asked to select a photograph depicting the view of a doll house (a modified version of Piaget's three mountains tasks) as seen by a puppet from a particular vantage point. A shielded condition was used for half of the subjects. Shielding of the stimulus reduced egocentric errors among 4 years old children. The subjects found the task more difficult on trials with corner views particularly when a subject's own view included some of the cues present in the puppet's view point also.

(c) POST PIAGETIAN STUDIES ON EGOCENTRISM IN RELATION TO OTHER CHARACTERISTICS

A number of researchers have attempted to study egocentrism in relation to other variables such as communication, social influence, popularity, culture, MA, CA, conservation, field independence, moral judgement etc.

Egocentrism and Communication

VYGOTSKY (1962) - Vygotsky (1962) on the basis of his observation, concluded that the younger children's speech is highly egocentric. But he disagreed with Piaget's point of view that egocentric speech (private speech) disappears with age and is replaced by socialized speech. He is of the point of view that egocentric speech has its own function namely of cognitive self guidance. As the age of the child increases, egocentrism goes underground as verbal thought or in other words becomes inner speech.

Egocentrism and Social Interaction

HOLLOS & COWAN (1973) - According to Piaget (1928) egocentrism decreases as the child comes in contact with others. Hollos & Cowan have attempted to test the hypothesis: children who get more opportunity or social interaction would be less egocentric and would perform better on the role taking skill. They examined role taking skills in 7-9 year old children of Norway who were living in three

different social settings: a farm community, a village and a town. According to the researchers' analysis the farm community provided the children very little opportunity for peer interactions, the town provided highest opportunity for such interactions. The village stood in between the two in this respect. Equal number of children (half boys and half girls) were selected from each social setting. These children were administered tasks of conservation, classification and role taking. He found that farm children performed more poorly on several role-taking tasks than the children reared either in town or village. Factor analysis revealed two factors: a logical operation factor involving all classification and conservation tests; and role taking factor involving all multiple perspective and communication tests.

WEST (1974) - The study of West is an extension of the study conducted by Hollos & Cowan (mentioned above). He investigated the effect of early social experience on the development of role taking skills. 108 boys (for I trial) were selected from three social settings: kibbutz, moshav and city. Half of the subjects of each setting were studying Kindergarten and half in third grade. As far as the social interactions provided by these settings are concerned, kibbutz are more peer dominated. They are housed together by age in residential units and are looked by a caretaker or

metapelet. The nuclear family of moshav resembles that of the city or small town in Israel. Children in city culture of Israel are expected to have lesser opportunity for frequent early peer contact. Role-taking skills were measured with two visual perspective tasks and a cognitive decentering task. It was found that some amount of social interaction in early childhood are necessary for development in these areas. But beyond certain level differences in such experiences fail to contribute differentially to individual achievement. According to West other factors should be looked into as accounting for individual difference in role-taking skills.

RUBIN, K. (1973b) - Rubin has also investigated the influence of social interaction on role-taking skills. He administered Piagetian conservation and spatial egocentrism tasks (three Mountains task) to 28 institutionalized and 27 noninstitutionalized old people (70-85 years old subjects). These subjects had similar educational background. The institutionalized subjects had fewer social interactions than the noninstitutionalized subjects. From this study it was found that institutionalized group performed better on the Piagetian conservation tasks, than the other one. The non-institutionalized group was superior on spatial role-taking task. The researcher explained this finding in reference to Piaget's belief that social

interactions play a crucial role in the evolution of decentration skills. It appears from the report that group who did better in conservation has not done well in role-taking task, a finding which does not agree with common belief that decenteration is a necessary condition for the development of conservation. The old age of the subjects might have some how affected the results of this study.

Egocentrism Popularity and Conformity

RUBIN, K. (1973 C) - Rubin has conducted another study to examine the relationship between egocentrism and popularity. According to Piaget children who are better able to consider an auditor's point of view will be more popular with their peers. In other words more egocentric children are less popular than the less egocentric children. Rubin administered the task of communicative egocentrism and a test of sociometry to 80 children of Kindergarten and grades 2, 4, and 6. The result obtained from this study supported Piaget's view point. But this was true only in the case of Kindergarten and second grade children. Hardly any relationship was found between popularity and role-taking in the fourth and sixth grade children. It may be due to other factors contributing to popularity among older children. Whereas in the younger children it may be a important contributory factors in the development of role-taking.

DEUTSCH (1974) - Deutsch (1974) also studied the relationship between communicative egocentrism and popularity in 60 preschool girls ranging in age from 3 to 5 years. Two measures of popularity were obtained. One was a realistic measure of actual classroom interaction (based on observation) and another a sociometric measure of preferred playmates. It was found that communicative egocentrism was significantly related to the observational measure of peer popularity but it was not significantly related to the sociometric measures of popularity. It seems from this study that realistic measures and sociometric measures of popularity are somewhat different characteristics. Before accepting this finding, more supporting evidence will be necessary.

Egocentrism and Moral Judgment

SELMAN (1971) - A study was done by Selman to investigate the relationship between moral judgment and role-taking skills. 60 middle class children between the ages of 8 to 10 years were administered Kohelberg's moral judgment scale and two role-taking tasks. The intelligence of these subjects was controlled with the help of Peabody Picture Vocabulary Test. From this study it was found that role - taking skill was related to moral judgment.

RUBIN, K. (1973d) - In another study Rubin studied the relationship between moral judgment, egocentrism and

altruistic behavior in 55 subjects aged 7 years. He noticed that communicative egocentrism was significantly related to moral judgment.

Egocentrism, Emotionally Distrubed and Delinquent Children

NEALE (1966) - Neale tested a hypothesis that emotionally disturbed children would show greater egocentrism than a normal control group.Piaget's three mountains task was administered to 20 emotionally disturbed subjects and 20 public school children. The former group of subjects was taken from the institutions for emotionally disturbed children. He found that institutionalized children (emotionally disturbed) were more egocentric than the other emotionally non-disturbed group.

SIMOONSSON (1973) - Simoonsson studied the effect of emotional disturbance on the performance of Piagetian perspective tasks. For this study four groups of subjects were selected: Non-disturbed group, (N = 15), special class (N = 15), residential schools (N = 15) and institutionalized group (N = 10). The fourth group was more severely emotionally disturbed as compared to other three groups. It was found that non-disturbed group was less egocentric than the other three disturbed groups on Piagetian perspective tasks. On the other hand in the institutionalized group, more egocentric responses were noticed.

CHANDLER (1973) - Egocentrism has been studied in relation to anti-social behavior also. Chandler (1973) in his study examined relationship between social egocentrism and chronic delinquent behavior. He also developed a programme of remedial training in deficit role - taking skills. The study was conducted on 45 delinquents and 45 non-delinquents between the ages of 11 to 13 years. He noticed that a substantial portion of the chronically delinquent subjects demonstrated a marked lag in their ability to successfully adopt the roles or perspective of others. The training in role-taking skills did reduce substantially a high level of social egocentrism. This observed changes in role - taking skills were also found to be associated with a measurable reduction in the amount of delinquent behavior among the experimental subjects.

Egocentrism And Field - Independence

Field - independence also called as psychological differentiation (Witkin 1962) simply mean seperation of a part from an organized perceptual field. This is a developmental phenomena.

BOWD (1974) - Bowd has examined the relationship between field - independence and various forms of ego-centrism in 53 Kindergarten children. He did not find any relation between these variables.

FINLEY et al. (1977) - Finley et al. has investigated the relation of field dependence (or independence), egocentrism and conservation. 116 middle class second grade children were individually administered Embedded Figure Test. On the basis of this 26 most field-independent and 26 most field dependent subjects were selected. Half of the subjects in each group were males and half females. Two months later a battery of egocentrism and logical operation tasks were administered to these subjects. From this study, the researchers found that field independent subjects were less egocentric and likely to be better conserver. No sex difference was observed in this study.

KANUDSON et al. (1977) - Kdnudson et al. has done a study to find if the development of perceptual role-taking skills is related to the development of field independent in Mexican, American, and Anglo American cultural backgrounds. The result obtained from this study showed that perceptual role-taking skill (reverse of spatial egocentrism) was significantly related to the field independence. No tendency towards a cultural difference was found.

Egocentrism and Conservation

RUBIN, G. (1971) - Rubin did a study which was concerned with reduction in egocentric behavior as a result of conservation learning. 15 Chronic Schizopheranic patients

who were initially non-conservers were trained in Piagetian conservation tasks by means of a method of logical justification. He found that with the increase in conservation (due to the training) the egocentric behavior of the same subjects decreased. This appears to be a very important finding. But as the sample size was rather small the result needs confirmation with a larger sample.

RUBIN, K. (1973d) - Rubin, selected 20 children each from kindergarten and grades II, IV and VI to examine the relation of egocentrism to conservation, CA and MA. Interrelation among various forms of egocentrism was also studied. Four forms of egocentrism - Communicative, Cognitive, role-taking and spatial* - were measured with the help of different tests. Goldschmid & Bentler's concept Assessment Kit - Form A, a Sociometric test and Peabody Picture Vocabulary test were administered to assess conservation, popularity and intelligence respectively. IQ ranged from 71 to 140 with a mean of 102.9 and SD 12.5. From the factor analysis, the researcher found that all forms of egocentrism, except cognitive egocentrism, conservation, CA and MA had loading on a single factor - decentration. It was concluded that all forms of egocentrism except cognitive egocentrism are interrelated, egocentrism was also found to be related to conservation, CA and MA.

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*For measurement of spatial egocentrism Rubin used the same tool as has been used in the present study.

RUBIN et al. (1973) - These researchers conducted another study on five age groups of 132 males and females (7.63, 11.55, 21.07, 44.10, and 76.33 years old). All subjects belonged to middle class. The spatial egocentrism and conservation were the main variables in this study. The variables were assessed with the same tasks as done in the earlier study of Rubin. In this study no significant sex difference was found. University and middle aged subjects performed better on the conservation tasks than the youngest and elderly groups. But on the tasks of spatial egocentrism the elderly group was superior to 11 year old subjects and inferior to remaining adults. They also studied the relationship between the educational attainment and success on spatial role taking and conservation measures. The correlation was found to be not significant. It can be argued that better role - perception and better development of conservation would lead to better academic achievement which was not found in this study. As such this study of Rubin et al. would call for further investigation in the area.

Studies on Interrelation Among Different Forms of Egocentrism

RUBIN (1973 a) - Some of the researchers have attempted to investigate whether egocentrism is a unitary construct or different skills are involved in different types of egocentrism. For example Rubin (1973a) in a study (stated above)

found that measures of all forms of egocentrism indicate loading on a single factor - decenteration.

RUBIN (1974) - In another study of Rubin (1974) relationship between spatial egocentrism and communicative egocentrism was investigated in four age groups (7 year, 11 year, 21 year and 76 years). It was found that two forms of egocentrism were only significantly related for the group of 11 year and 21 year old subjects. Non-significant relationship between the two forms of egocentrism was found for the youngest and elderly groups. The non-significant correlation for the elderly group was interpreted as the reflection of the onset of neural disruption or in Piagetian term the "structural disintegration". The 21 year old subject were superior to subjects of the other three groups. While youngest group and the elderly groups were inferior. This finding supports Papalia's (1972) point of view that Piagetian cognitive variables follows a curvilinear developmental pattern.

COWAN (1966) - Cowan has found a positive relationship between spatial egocentrism and communicative egocentrism. Children who had done better on Piaget's three mountains problem used significantly less egocentric speech during communication than those who had done poorly on these tasks.

Egocentrism and Effectiveness of Training

COX (1977) - Cox has conducted a controlled experiment with three,5 year old groups. He concluded that effective improvement could be brought in responses to Piaget's three mountains task by training. Verbal feedback method, explaining mistakes or correcting a subject's response could bring substantial improvement. In the other method (Visual) the subject first observed, a display from his own position then changed his position and described how from the other position the display was seen. This method was not so effective.

SECTION-B

STUDIES ON CONSERVATION

PIAGET's ORIGINAL STUDIES ON CONSERVATION

Piaget has done a number of studies covering different aspects of conservation. He used a variety of tasks to assess conservation of such concepts as substance number, length, distance, area, weight, volume, etc. On the basis of these studies he concluded that a child does not develop any idea of conservation before the age of five or so. In the begining he gets a feeling of conservation intuitively and a year or two later he starts using formal reasoning in explaining conservation. Piaget & Inhelder (1941) have concluded that conservation of different

concepts do not develop at the same age. The concepts develop in the following sequence: Conservation of substance at about 7 years*, conservation of weight at about 9 years conservation of volume at about 12 years. Conservation of number was found to develop at about the age of six or seven (Piaget 1952) and conservation of length and area at the age about 7 to 8 years (Piaget 1960).

Piaget's Studies on Conservation of Continuous Quantities

In studying conservation of continuous quantities Piaget (1952)** has used too cylinderical containers of same size and shape. Then each of the container, was filled with equal amount of some coloured liquid. He then poured the whole of the content of one of the container into another (long and narrow or short and wide) cylinder and asked the child if the quantity in both containers were of the some amount.

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*The ages mentioned here are average ages as found by Piaget & Inhelder. Some of the children will develop conservation a year or two earlier or later than the age mentioned above. In some of the studies conducted in Teachers' College Jamia Millia (Bhardwaj 1969, Seth, 1974) it was found that some children in Delhi start developing conservation of number and substance at the age of 5. Piaget (1952) also found that in the situation of simple transformation the children of 5½ years could conserve a quantity. Researchers working in different parts of the world have found different average ages for conservation of different concepts.

**The original French addition was published in 1941 whereas the first English version was published in 1952. In the bibliography only English version has been mentioned

In another experiment he poured the contents of one of the containers into two or more identical containers and asked if the contents of these two/three together was equal to, more or less than the contents of the other container .

Piaget's Studies on Conservation of Discontinuous Quantities

PIAGET (1952) - Piaget has conducted a number of experiments to study the conservation of discontinuous quantities. In one of such experiments (Piaget, 1952 P. 27) the subjects were shown same number of red and green beads of equal shape and size. The red beads were put in one container and the green beads in another container of the same size and shape. Then the child was asked if the green beads are threaded into one string and the red beads into another, would the two neclaces be of the same length. After getting the answer it was shown by doing. Then the child was again asked the prediction question if the beads of one of the strings are poured into a third container (long and narrow/short and wide), would the beads of the container and the neclace be equal in quantity. Then it was illustrated and the same question was asked. From his experiments Piaget (1952) found that a child of 5½ years is capable of postulating conservation when there is slight change in the object of comparision. It is at the age of 7 to 8½ years that children are able to conserve

a discontinuous quantity even when the object perceptually look significantly different. Because at this stage operation of multiplication of relations develops(e.g. long and thin, short and wide) which is important for conservation.

Piaget's Original Studies on Conservation of Length

Piaget et al. (1960) has used a number of tasks to assess conservation of length. He has studied conservation under two headings:

(i) Change of position and conservation of length.
(ii) Conservation of length with distortion of shape.

One example of each is being discussed below:

(i) Change of Position and Conservation of Length:

The idea behind this is that transformation is made only by placing or moving one of the objects into another position. For example in one of his experiments two straight stick identical in length were shown to the child. First they were placed in such a way as to have their ends in prefect alighment to show the identity of length. Then one of the sticks was moved forward 1 or 2 cms. and the child was asked whether both the sticks were of equal length or any of one was longer or shorter than the other stick. In the same way questions were asked after making the shape of letter 'T' or 'V' with the two sticks.

(ii) Conservation of Length With Distortion of Shape

Tasks used under this heading can be described of those types in which transformation in one of the comparision object was made by distorting the shape of it.

In one of such experiments the child was shown two equal pieces of paper each 30 cm. long and 1 cm. wide. The subject was first assured that both of the pieces are equal in length. Then one of the pieces was cut into two parts, then in several, and these pieces were arranged in a variety of ways. Then the child was asked whether the intact piece of paper and the small pieces together were equal in length.

From such experiments Piaget et al. (1960) concluded that the idea of operational conservation, "which entails the complete co-ordination of operations of subdivision and order or change in position" is accomplished between the ages 7 year 6 months to 8 years 6 months (Piaget et al. 1960, P. 119).

Piaget's Original Studies on Conservation of Area

As in the case of conservation of length so in the case of conservation of area Piaget et al. (1960) devised a number of tasks to study the development of conservation of area in children.

In one of his widely quoted experiment Piaget et al.(1960) used the notion that if two equal parts are taken from two equal wholes, the remainder would also be equal. Child was shown two rectangular sheets (20 cm. x 30 cm.) of green card board and was told that they were meadows which were equal in size. Then on each sheet a model of small cow was placed. The experimenter told the child that both the cows were consuming equal amount of grass from their respective meadows. Then a little wooden man was shown to the child and he was told that this fellow was a farmer. A small cube was also shown to the child to serve as farmhouse.

First a cube was placed in one of the sheets (the first meadow B1) and another on the other sheet (B2) in the same relative position. Then the question was asked "Is there as much green left in this meadow as there in this one?" After getting the correct answer one cube was placed in the centre of B1 with the length of the cubs parallel with the length of the meadow, another at one end of B2. Then the same question was repeated. In the same way equal number of cubes were placed on each sheet but in different arrangements. Each time after placing the cubes, the question about equality of remaining areas of two meadows was asked.

Piaget et al. used another type of tasks also, to study conservation of area. Two identical squares of card board were shown to the children. They were assured that

both the squares were equal in area. The experimenter then cut one of the squares to form two rectangles. These two rectangles were arranged perpendicularly and then the child was asked. "Is there still the same amount of room on there (two rectangles) as there is on here (square)". After getting the correct answers the two rectangles were again cut into pieces and the same question was asked after each arrangement of these pieces.

By using the first type of tasks Piaget found that children upto the age of 5½ to 6 years could recognize that green spaces remaining were equal so long as the arrangement of the houses in two meadows were identical. Any variations in the arrangement of these houses led them to say that green spaces were unequal. By using different tasks to assess conservation of area Piaget et al. (1960) came to the conclusion that children reach the level of operational conservation of area by the age of 7 or 8 years.

In the same way a variety of complementary methods have been used to study the conservation of weight, volume etc., which are not relevant for the present study.

2. POST-PIAGETIAN STUDIES ON THE MEASUREMENT OF CONSERVATION

A number of studies have been done in order to examine the effect of kinds of questions used, materials etc. on the performance of conservation tasks. Researchers

have also attempted to use the psychometric approaches in the construction of conservation tests. This will be discussed in Chapter III.

PRATOOMRAJ & JOHNSON (1966) - Pratoomraj & Johnson studied the kinds of questions and types of conservation tasks in relation to children's conservation responses. 16 boys and 16 girls at each age level from 4 to 7 years were administered individually conservation task of substance. Each subgroup was asked only one kind of question. The four kinds of questions were framed by using the one out of four phrases. "Is it the same?, Is there more?, Is there less? or Are they different?" It was found that kinds of questions did not have any effect on the children's conservation responses. Children demonstrated more conservation responses to questions involving prediction than to questions involving judgment and explanation. But this was not true in the case of four and five year old subjects.

SIEGEL & GOLDSTIEN (1969) - Siegel & Goldstien attempted to test the 'recency' hypothesis that young children would select the last alternative presented to them rather than the correct relational one. This study was done on 66 middle class children ranging in age from 2 years 7 months to 6 years 1 month. In order to examine the 'recency' hypothesis the use of terms "more" and "same"

was varied in the questions of conservation tasks of number in an organized manner for each subject. For example if "more" appeared last in Question 1, it occured first in Question 3. Half of the subjects had "same" first and "more" last and the other half had the reverse of this. The results demonstrated that younger children tended to choose the latter of the two alternatives offered to them.

ROTHENBERG (1969) - Rothenberg studied some of the methodological problems associated with conservation, among 210 children of preschool and kindergarten low and middle socio-economic background. From the results of this study he concluded that an identification of full operativity is the function of conservation questions asked and the number of transformations made in a conservation task.

PEISACH & WIEN (1970) - A study was conducted by Peisach & Wien to find the relationship between the difficulty level of conservation tasks and the type of explanations. 180 kindergarten and first grade subjects were covered. It was found that more difficult items elicited more dimensional explanations (e.g. this one is longer). On the basis of this study Peisach & Wien concluded that inability to present the reasonable explanation on conservation tasks is not only a function of verbal

skill but also it reflects the lower level of conservation conceptualization. They also supported Piaget's contention that explanation are essential evidence of conservation.

ZA'ROUR (1971a) - Za'rour in one of his studies examine the effect of familiar and nonfamiliar materials on the performance of conservation tasks. With the help of three types of materials conservation of weight was assessed. The three types of materials were (i) balls of red plasticine (ii) rubber band (iii) a thermometer with alcohol dyed blue. The results of this study demonstrated that for 7 - 9 year old children it was easier to conserve when plasticine was used.

LLOYD (1971) - Lloyd also studied the effect of familiar and nonfamiliar materials on the performance of conservation tasks among Yaruba subjects. It was found that performance on conservation task was similar with familiar and alien materials.

HARDMAN & PEISACH (1977) - Hardman & Peisach have conducted a study to examine whether conservation tasks of equality and inequality are of equal difficulty or any kind of conservation task is more difficult than the other. Both kinds of tasks were administered to 180 children of Kindergarten, first and second grade(boys and girls). In

the case of discontinuous quantity the two types of tasks were equal in difficulty. But when dealing with continuous quantity, the children found the tasks requiring conservation of equality easier than those requiring conservation of inequality.

C. POST PIAGETIAN STUDIES ON CONSERVATION IN RELATION TO OTHER CHARACTERISTICS

A number of researchers have done studies to verify the developmental stages of conservation, as well as the sequential development of conservation of different concepts. Conservation has also been studied in relation to a number of variables. Here it will not be possible to present a full account of the studies done on conservation. Only few examples would be cited under the following heads:

(i) Studies on sequential development of conservation.
(ii) Studies on types of conservation.
(iii) Studies on conservation related to other variables.
(iv) Studies on training of conservation.
(v) Conservation studies in India.

(i) Studies on the Sequential Development of Conservation

According to Piaget conservation of different aspects (e.g. mass, weight, length, area, volume etc.),

do not take place at the same age. There is a sequence. For instance conservation of mass, weight and volume develop in this order. A number of researchers have attempted to verify this contention of Piaget.

ELKIND (1961) - Elkind replicated Piaget's conservation tasks of mass, weight and volume among 469 Junior and Senior high school students from a middle class background. The results of the study agreed with the findings of Piaget that conservation of mass develops first, then develops conservation of weight. Conservation of volume develops last amongst the three.

There was slight disagreement with Piaget's findings. Piaget has mentioned that conservation of volume develops in majority of children at 11 to 12 years old. Elkind found that only 27% of 11 to 12 year olds had developed conservation of volume. Even in the college students he found that only 58% of them had developed the same concept. Sex difference was obtained in the attainment of conservation of volume amongst the college students. Men performed better than the women on these tasks.

UZGIRIS (1964) - Uzgiris administered conservation tasks of substance, weight and volume to 120 subjects of first to six grades. The result of this study supported Piaget's contentions of sequential cognitive development of the conservation of substance, weight, and volume.

The results also were in agreement with the ages suggested by Piaget at which such concepts are acquired.

(ii) Studies on the Types of Conservation

According to Elkind (1967) there are two kinds of conservation: identity and equivalence. A number of researches have been done to find out the relationship between these kinds of conservation and the ages at which these conservation develop.

HOOPER (1969) - conducted a study to examine which type of conservation develops first. One identity and two equivalence problems were presented to 54 young children (Kindergarten and first grade). It was found that equivalence conservation appeared later than identity conservation.

NORTHMAN & GRUEN (1970) - Northman & Gruen attempted to find the order of development of these two types of conservation. 60 children ranging in age from 6 years 11 months to 9 years eight months were administered three equivalence and three identity conservation tasks. This study supported Piaget's (1956) view point that these two types of conservation emerge simultaneously.

PAPALIA & HOOPER (1971) - Papalia & Hooper on the basis of their study conducted on 60 subjects ranging in age from 4 to 6 years concluded that identity conservation develop prior to the equivalence conservation in the case of the concept of area. But they could not find any evidence in respect to number conservation.

MOYNAHAN & GLICK (1972) - Study of Moynahan & Glick demonstrated that identity and equivalence conservation were present in the majority of the tasks used to assess conservation of different concepts. In both conditions the conservation task of length, quantity and weight were of similar difficulty.

ELKIND & SCHOENFELD (1972) - On the basis of a very recent study Elkind & Schoenfeld have concluded that identify and equivalence conservation require different mental processes. They found that difference between the two types of conservation was more apparent among younger children.

(iii) Studies on Conservation in Relation to Other Variables

The conservation studies which have been done in relation to other variables can be grouped into the following heads:

(a) Conservation, Culture and Education.

(b) Conservation, age, sex, intelligence, field independence, reading ability.

(a) Conservation, Culture and Education

DELEMOS (1969) - A study was conducted by Delemos on 145 subjects of two Aboriginal Settlements of Australia. These subjects were ranging in age from 8 to 15 years. Piagetian conservation tasks of number quantity, length, weight, area and volume were administered to these children. It was found that the conservation of area developed much later in Aboriginal subjects than in European subjects and in some cases this concept did not develop at all. The researcher did not notice the invariant order of development among Aboriginal Subjects for conservation of quantity, weight and volume. He mentioned that educational language and genetic factors were responsible for differences between Aboriginal and European subjects. More systematic study would be required to verify this position which may be used as hypothesis.

WASIK & WASIK (1971) - A study by Wasik & Wasik was conducted to examine the performance of culturally deprived children on concept Assessment Kit: Conservation. 117 subjects ranging in age between 6 to 9 years were selected from an ungraded primary school for culturally deprived children. The results demonstrated that culturally deprived

children were taking one to two years longer to attain the level of acquisition of conservation than the normal group.

GAUDIA (1972) - Gaudia investigated relation of race, social class and age to the Piagetian conservation tasks. The sample consisted of 126 Indian, Negro and white subjects of America studying in grades I, II & III. All subjects belonged to lowest social class. These subjects were administered Form A of the conservation Concept Assessment Kit (Goldschmid & Bentler 1968). The results of this study showed difference in the rates of acquisition of conservation between children of different racial and social background. Negro children performed at a lower level of conservation operativity than Indian and White children.

GOLDSCHMID et al. (1973) - A Goldschmid et al. have conducted a study on 250 children, of Australia, Holland, England, New Zealand, Poland and Uganda. The subjects' age range was between 4 to 8 years. It was found that the age trends in conservation development for boys and girls were fairly consistent from culture to culture. The role of conservation acquisition differed somewhat across the samples studied. These variation may be due to specific environmental differences among the groups compared.

MWANGANGI (1975) - Mwangangi has conducted a study to examine the effects of environment (rural versus city), sex and age upon the performance of Piagetian conservation tasks of clay, water, number and area. The subjects' age range was from 6 to 10½ years. They were selected from the rural and city schools of Kenya. Rural school children performed better on clay conservation. No significant difference was found between rural and city children in respect to the conservation of water, number and area. The ages of acquisition of conservation was found to be closely parallel to those of children from Western cultures.

GREENFIELD (1966) - Greenfield studied the conservation of liquid in senegal. There were three groups of children (i) bush unschooled children from a rural village (ii) bush schooled children from the same village (iii) city schooled children. The results demonstrated that there were differences between the younger children (6 to 9 years) in the three groups. But after the age of 8 to 9 years also the unschooled children showed a qualitative change in the performance of conservation tasks. Lack of schooling was clearly more relevant than rural vs. urban environment on the ability to conserve liquid quantity.

MERMELSTEIN & SHULMAN (1967a) - Mermelstien & Shulman compared the performance of school going and non-

school-going children on a series of Piagetian tasks. The possible effects of non-schooling on conservation were investigated on a total sample of 120 children. 60, Six to nine year old non-school going children and 60 school going children (6-9 years) were matched for CA and Sex. Conservations of continuous quantities and discontinuous quantities was assessed with verbal and non-verbal techniques. The results of this study showed no significant difference between non-school going and school going children on the performance of conservation tasks. Differences between verbal and non-verbal tasks were found to be highly significant.

OKONJI (1971) - Okonji studied the performance of school going and non-school going children (aged 6 to 11 years) of Uganda on Piagetian type tasks (conservation of length, angular measurement etc.). It was found that a higher proportion of subjects attending school achieved conservation of length than non-school going children.

GRAVES (1972) - Graves has investigated whether race, sex, education has any effect on the degree of acquisition of conservation of mass, weight and volume. 60 white and 60 black subjects (half of the subjects in each race were female) were categorised into three levels of education based on 'Adult Basic Learning Examinations'. No significant racial difference was found. The level of

education was significant only in the case of conservation of mass. A significant sex difference was found in favour of male in the acquisition of conservation of volume.

(b) Studies on Conservation in Relation to Age, Sex, Intelligence Field-Independence, Reading Ability etc.

As far as the question of age at which the idea of conservation is developed there is a lot of controversy among the researchers. Brain (1964), Bruner (1966) and Mehler & Bever (1967) on the basis of their studies have concluded that children between the ages of two years six months to five years are able to conserve number concepts. This is contrary to Piaget's contention that the idea of conservation develops after the age of five years (at 6 years or above). The findings of Mehler & Bever (1967) have been questioned by a number of researchers including Piaget himself (Piaget 1968, Rothenberg & Courtney (1968), Beilin 1968, Rothenberg 1969 etc.). For example Piaget (1968) and Beilin (1968) have rejected the application of the term 'conservation' to the Mehler & Bever results. According to Siegel & Goldstien (1969) technique used by Mehler & Bever, tests the understanding of relational concept of "more". But this procedure does not test the ability to make conservation responses which involves recognition of identity.

Regarding Bruner's (1966) procedure it can be said that he was satisfied with simple statement like yes/No,

equal/unequal, same/different (judgment responses). He did not considered 'justification responses' which are concerned with 'Why' and "How" of the answers.

According to Gruen (1966) the difference in the results of conservation studies may be attributed to the different criteria of conservation used by the researchers.

ZA'ROUR (1971) - Za'rour examined the effect of sex, SES, religion, scholastic level and mother's literacy on conservation of number. This study was conducted on 224 Labanese children ranging in age from 5 to 9 years. The relation of sex and conservation was found to be significant at .05 level only for the number tasks. Religion, scholastic level, SES, and mothers' literacy were not significantly related to conservation.

BAT-HAEE et al. (1972) - Bat-Haee et al. studied the relationship between Piaget's conservation of quantity tasks and three measures of intelligence. 35 boys and 30 girls of Ist and fifth grades were administered Piaget's conservation task of quantity, Raven's coloured Progressive Matrices and WISC vocabulary and Arithmatic scales. It was found that there was positive correlation between the three measures (correlation ranged from .36 to .45). The researchers interpreted these results as an indication of factor common to Piaget's tasks and psychometric tests of intelligence used in this study

DEVRIES (1974) - DeVries tried to find out the relation between Piagetian conservation tasks and IQ and Piagetian conservation tasks and achievement tests. 143 children were divided into three groups: high, middle and low IQ groups on the basis of their performance on Stanford Binet Test. These subjects were administered a series of tasks including conservation tasks of number, mass, length and liquid. California Test of Mental Maturity and Metropolitan Achievement Test, were also administered to the subjects. On the basis of results of this study DeVaries concluded that "Piagetian tasks do appear to measure a different intelligence and a different achievement than do psychometric tests " (DeVries 1974 P. 746). However it was found that Piagetian IQ and achievement tests overlap to some extent.

PAGE (1974) - Page has examined the effect of levels of SES (middle and low) on the acquisition of conservation of identity and equivalence among Kindergarten and first grade children. It was found that a greater proportion of conservation responses were given by middle class subjects. At Kindergarten level the two groups of subjects significantly differed in the performance on conservation of identity tasks.

AYERS et al. (1974) - Ayers et al. studied the relationship among ability to conserve perceptual motor

skills, reading readiness and IQ among 94 Kindergarten and first grade children. These subjects were administered Purdu perceptual Motor-Survey, the Metropolitan reading Readiness Tests, Form A of the Peabody Picture Vocabulary Test to assess perceptual-motor skills, reading readiness and intelligence respectively. Piagetian conservation tasks of number, liquid amount, solid amount, weight, length and area were individually administered. The researcher noticed non-linear relation between the scores on Piagetian conservation tasks and other variables. So eta correlation technique was used to determine the relation of conservation to other measures. Significant correlation were found between the measures of Piagetian tasks and IQ, conservation was also found to be significantly related to the Balance and Posture subtest of Purdue. According to the researchers this "indicates that ability to conserve is related to elementary motor - responses " (Ayers et al. 1974, P. 494). Conservation was also significantly related to reading readiness.

(iv) Studies on Training of Conservation

There are two views about conservation learning. According to one point of view, which is held by Piaget and his supporters, it is not possible to alter the sequence or bring about a rapid change in the acquisition of conservation. While on the other hand, quite a few

developmental psychologists, have the opinion that acquisition of conservation can be induced or accelerated. According to the second groups of researchers training the children to understand reversibility compensation, substraction/addition etc. would accelerate development of conservation. Some of the researchers also attempted to teach such relational terms as "equal to," "greater", or "smaller" "more" or "less" etc. to induce conservation. Effectiveness of training was seen in three respects: durability of learning, transfer of generalization to other cognitive strategies; operational level achieved by the learner; and resistance to extinction. Here only few studies will be illustrated.

WALLACH et al. (1964) - Wallach et al. have attempted to test three hypothesis: (i) Whether conservation could be induced by training in reversibility, without training in the acts of addition and substraction. (ii) Whether training in reversibility also with the acts of addition and substraction would accelerate development of conservation. (iii) Of the above mentioned two conditions which one is more effective. The results of this study indicated that reversibility training was effective in the inducement of number conservation and that such a training did not need to be accomplished by experiment with the acts of addition and substraction. Furthermore

in the absence of reversibility training, training in the act of addition and substraction by itself did not prove effective in the enhancement of conservation.

INHELDER et al. (1966) - Inhelder and her associates investigated the effect of language training on child's reasoning. They found that training in the relational concepts had considerable influence on non-conservers. These children after language training expressed themselves more consistantly as conservers on some conservation tasks. However this type of training did not make them total conservers.

MERMELSTIEN et al. (1967) - Mermelstien et al. on the basis of their studies done on 120 children, supported Piaget's point of view that conservation cannot be taught.

ROTHENBERG & OROST (1969) - Rothenberg & Orost taught the children addition and substraction and then concepts of "more" vs "longer". These researchers found that conservation of number could be taught to young children. The effect of training was found to be lasting after a period of 3 months.

In this way training has also been formulated to induce conservation of weight (Kingsley & Hall, 1967, Lister 1972); Liquid (Minichiello & Goodnow, 1969, Strauss

& Langer, 1970), Length (Sawada & Nelson 1967) etc.

Some of the researchers working in this area got success while others failed to induce conservation. This diversity of results may be due to the fact as Inhelder* states that comprehension of conservation necessitates the development of numerous interrelated processes. So training only in some logical processes or language may not be sufficient for the inducement of lasting conservation.

(v) Studies of Conservation in India

In India very few studies on conservation have been done. The present researcher could find the following studies on conservation.

MUHAR & JAIN (1969) - Muhar & Jain studied the development of conservation in urban and rural children aged 6 to 11 years. 60 children (rural and urban) were individually administered conservation tasks of quantity. Results demonstrated that development of conservation of quantity starts at an earlier age in urban school children.

RAO (1976a) - Rao has conducted an experiment to study the development of conservation of length, mass,

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*Inhelder cited in Green D.R., Ford M.P. & Flamer G.B. Eds. (1971) Measurement and Piaget, New York: McGraw-Hill.

weight number, area and volume. 320 children ranging in age from 4 to 6 years old were administered Raven's coloured Progressive Matrices. On the basis of scores they were divided in two ability groups: low and high. It was found that children of different age levels significantly differed from one another in their performance in conservation tasks. Sex difference was also found to be significant. He also found that the children with higher level of ability performed better than those with lower level ability. The performance on conservation tasks of volume and area of high level group did not differ from those of low ability subjects. He found that length conservation develops first and area later. In between these two develop conservation of number, mass, weight and volume. His finding that conservation of volume develops earlier than conservation of area does not agree with the findings of Piaget and others. This question needs further probing.

RAO (1976b) - Rao conducted another study to investigate the effect of sex, SES age and conditions of testings of the performance of conservation of mass, weight and volume, among 432 subjects. These subjects were in the age range of 4 to 8 years. It was found that SES was significantly related to conservation. However sex and condition of testing were not significantly related to the conservation of mass, weight and volume.

In his earlier study Rao found that sex was significantly related with conservation, whereas in this he has found no significant relation. This question will need further investigation.

BEVLI (1976) - The study investigated (A) level of development of concept of speed in Indian children coming from (i) adventaged urban, (ii) disadvantaged urban and (iii) rural, groups. (B) The second purpose of the study was to see if a specially devised training programme can accelerate the acquisition of this concept among the first two groups. The development of the cognitive operation involved in the concept of speed among Indian Children follow the same pattern as those of Genevan children, studied by Piaget (1946). However differences were found in the ultimate level reached and the rate of development in the three age groups. The result showed a systematic delay of the rural children as compared to those of socially advantaged urban children. 2-3 years' delay was also seen in advantaged group covered in this study as compared with the Western children.sex difference was seen in the urban advantaged group only, in favour of boys. Intelligence was found to be highly correlated with the concept of speed. The training was not effective in the sense that children at initiative stage did not reach the operational level but there was improvement in the quality of responses.

More children at transitional level gave operational responses as compared to non-operational children. Disadvantaged group found more difficulty in learning concept involving abstract idea.

SIDDIQI & BHANDARI (1977) - Siddiqi & Bhandari studied cognitive development of Primary school children in two Phases: Phase 1 (Dec., 1975 to 1976), and Phase 2 (Dec. 1976 to Feb. 1977). 450 subjects were covered in the first phase and 756 subjects in the second phase. These subjects were selected from first to fifth class. These subjects were administered conservation tasks of number, weight, area and volume. It was found that only 16.7% and 32.2% were conservers in Ist and second grades respectively. At fifth class 50% of the subjects could conserve area.

CONCLUDING REMARKS ABOUT THE STUDIES ON EGOCENTRISM AND CONSERVATION

Although a number of studies have been reported in this Chapter, but majority of them are not directly connected with the study undertaken by the present researcher. There is only one study (Rubin 1973a) which is concerned with the relationship between egocentrism and conservation. In this study it was found that both measures are significantly related. The researcher could

not find any study in which relationship between egocentrism and intelligence has been investigated. There are a number of studies (Bat-Hae, 1972, DeVries 1974, Rao 1976a) indicating that intelligence and conservation are positively related.

The study of Ayers et al. (1974) found a nonlinear relation between Piagetian tasks and other measures (perceptual motor skills, reading readiness and IQ.).

CHAPTER - III

THE PLAN OF THE STUDY

TOOLS NEEDED

It has been stated earlier that primary objectives of the study are (i) to find out the relationship between the measures of spatial egocentrism and conservation of length and, (ii) the relationship between spatial egocentrism and conservation of area. For this purpose it would be necessary to collect data on these three variables. So suitable tools were needed for the assessment of spatial egocentrism, conservation of length and conservation of area.

A number of researchers (Elkind 1961; Dudek et al. 1969) on the basis of their studies have found that intelligence measured by psychometric tests is moderately related with the measures of Piagetian tasks, while others (Beard 1960, Dodwell 1960) have reported low relationship between the measures on Piagetian tasks and IQ But Hase et al. (1972) and Rao (1976) in their studies found that IQ is significantly related with the measures on Piagetian tasks (conservation). Kohlberg & DeVries (1974) give some what different pictures. On the basis of their factor analytic study they have demonstrated that Piagetian measures define factors separate from psychometric intelligence factors. According to DeVries (1974), "Piagetian

tasks do appear to measure a different intelligence and a different achievement than do psychometric tests. First they differ in their general perspective; and second, they differ specifically in how they assess intelligence." (DeVries, 1974 pp. 751-753). This statement suggests that their may not be any relationship between intelligence measured by a psychometric test and Piagetian tasks like conservation of length and conservation of area etc. Instead of taking any stand on a priori basis about this point it was thought that the question could be left open and an empirical answer may be sought about this question. So it was decided that an intelligence test (psychometric test) could be used to find if the three variables mentioned above are related with intelligence and if so the observed relationship between spatial egocentrism and conservation of length, and spatial egocentrism and conservation of area may be partly or wholly due to a third factor - intelligence. So a fourth tool needed for this study was a psychometric test to measure intelligence (This point would be discussed later in this chapter.)

SOCIO-ECONOMIC STATUS

In India Rao (1976) has studied the relationship between the measures of SES and Piagetian tasks and found significant correlation between them. The researcher could have used a socio-economic status scale either to

control SES or take different SES groups (for studying the effect of SES on different Piagetian measures). But it was decided to control this variable in an indirect manner by selecting only one type of schools i.e. Municipal Corporation Schools. In Delhi a particular type of schools attracts children from a particular level of socio-economic status. For example, the public schools of Delhi are very costly so most of the children coming to such schools are from high socio-economic status families, and very few children, if any, come from low socio-economic status families. The schools run by Delhi Municipal Corporation do not charge any fee. So these schools draw children mostly from low socio-economic status group. In three such schools this assumption was checked by using the Kuppuswamy's Socio-economic Status Scale. It was found that a large number of children were from low Socio-economic Status and a few cases belonged to lower middle socio-economic status group. Not a single child was found who belonged either to higher middle SES group or to high SES group.

SAMPLING

Selection of Subjects

Piaget has not considered sex difference in cognitive development. However, in a round table

conference* held in 1955 Piaget has commented that boys and girls approach problems related to space, in different manner. Though Piaget has mentioned only one area space, the same may be true for other areas of development as well. Other researchers (Goldschmid 1967, Fogelman 1970) have also noticed sex differences in the performance on Piagetian tasks. Rao (1976) did not find significant difference in Indian children in the performance of boys and girls on Piagetian conservation tasks. But this may be true only for the lower age group. In many Indian families child-rearing practices differ for boys and girls. From this it can be argued that boys and girls come through different type of experiences. This may lead to sex difference in the level of cognitive development specially during the later childhood or adolescence. Without taking a stand on this question, it was decided that the study would be confined to either boys or girls. By a toss of coin it was decided that only boys would be covered by this study.

In Piagetian theory age is an important factor in the cognitive development. So children of only one age

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*Cited by Tanner & Inhelder (1958) in 'Discussion on Child Development, Vol. III, PP. 114, 154-162.

group would be taken for the study. The age group of the children to be covered by the study, would be decided after the try-out of the tests (discussed later in this Chapter).

In order to make constant the educational background of the subjects only children of one grade would be covered by this study. The selection of the grade for the study would be done after taking decision about the age.

Size of Sample

All the tools using Piagetian tasks (three such tools were actually used in this study) would be individual test and hence time consuming, only if a suitable group test could be found, intelligence of children could be tested in groups. The researcher would have to complete collection of data for her main study in about a year. In view of the fact that at least three individual tests would be used in the investigation, the researcher had to restrict the size of sample. It was decided that about 300 cases would be covered by this study.

Selection of the Schools

It has already been mentioned that only Municipal Corporation Primary Schools would be selected for the study.

As this study would be limited to one sex-male, so only Municipal Corporation Primary Boys Schools would be covered. In Delhi, all the Municipal Corporation Primary Schools are divided into 12 Zones (1976). Delhi is a scattred city. Most of the time would be wasted coming and going to the schools of all Zones, so it was decided that this study would be limited to Municipal Corporation Primary Boys Schools of New Delhi South Zone.*

First an alphabetical list of these schools would be prepared and then 37 schools (about 50% of the schools) would be randomely selected from the list, using tables of random numbers (Lindquist, 1940, PP. 262-264).

Selection of Children

On the basis of try out to be done in construction of the tasks of spatial egocentrism, conservation of length and conservation of area, age of children to which the main study is to be confined, would be decided. The grade in which the this age group of children would be available in larger proportion, would be taken up.

For each school an alphabetical list of children belonging to that particular grade and age would be

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*The present researcher was staying in NIE Campus which is situated in New Delhi South Zone. Much of the time could be saved by confining her study in that zone.

prepared and 50% of the names would be selected randomely. In this way about 300 children would be selected* for the the final study.

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*When such lists were made it was found in many schools the number of such children were less than eighth, from such schools all the children were taken. Only when the list contained more than eight then 50% of them were selected.

CHAPTER - IV

SELECTION AND CONSTRUCTION OF TOOLS

As construction of test takes a considerable time it is not advisable on the part of any researcher to take the responsibility of constructing all the tests needed for an investigation. A researcher first should make a thorough survey of the available tools, and if any suitable tool is found then that should be used in the study. In some cases a preliminary try-out with such tests/tools will be necessary before using it in the main investigation. Construction of new tests/tools is only necessary when no suitable tests/tools are available. This point was kept in view while considering about the tests/tools.

SELECTION OF INTELLIGENCE TEST

In India only a limited number of intelligence tests for children are available. Intelligence tests can be divided in two types:

1. Verbal Intelligence Tests
2. Non Verbal Intelligence Tests

1. Verbal Intelligence Test

While thinking about use of a verbal test, the question of local language should be kept in mind. The following Verbal tests (for Hindi speaking area) were

identified and considered:

(a) Individual Verbal Intelligence Tests

- (i) CIE Individual scale for children of 6-11 years.
- (ii) Adaptation of Stanford Binet Test, by Bureau of psychology, U.P.

These tests contain some non verbal items also for the lower age levels.

(b) Group Verbal Intelligence Tests

Following group verbal, intelligence tests were considered for this study.

- (i) Dr. Sohan Lal's Allahabad Intelligence Test for the 11 plus and lower age groups.
- (ii) Dr. Jalota's Group Test of General Mental Ability for the pupils of VIII grade and above.
- (iii) Test of General Intelligence By Dr. Mohsin for the pupils of VI to XI.
- (iv) Group Intelligence Test by Mehta for the children of 12 to 14 years.

Regarding the use of individual Verbal Intelligence tests it can be stated that these tests were developed long back and require thorough revision. The researcher could not find any important study in which these tests have been used in recent years. So in the absence of any supporting evidence regarding the reliability, validity and usability of these tests, the present researcher decided not to use these tests.

The other point for not using all the verbal group intelligence tests stated above is that these tests are meant for the higher grades and higher age groups. Apart from Dr. Sohan Lal's test these tests cannot be used for the primary school children as the present study was intended to grade V or below this. Dr. Sohan Lal's test was kept tentatively in mind but when it was finally dicided that the study would be confined to only 10 plus children (reason discussed later in this chapter), it was also rejected because this test is meant for 11 plus children. Even if the study were conducted with 11 plus children there would have been some practical difficulties in using Dr. Sohan Lal's Verbal Group Intelligence Test as well as all the other Verbal Intelligence Tests. In any corporation school of Delhi the mother tongue of majority of the children is not Hindi. Punjabi, Sindhi, Urdu etc. are spoken at home by most of these children. Indeed they read Hindi from grade one, it is quite likely that Hindi speaking children are at ease in Hindi than non - Hindi speaking children. In a recent Indian study (Tarang* 1979), it has been found that Urdu speaking students find certain difficulties while using Hindi, which are not experienced

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*Indeed the thesis was submitted in 1978, Tarang collected his data in 1976 while the present researcher was planning her study. She could get information about significant difference in the levels of Hindi achievement of Hindi and urdu speaking children from Tarang.

by Hindi speaking children. So this language factor might create some difficulty if any verbal intelligence test were used.

So due to above reasons the idea of using any verbal intelligence test was left and the search of some non - verbal intelligence test was made.

2. Non Verbal Intelligence Test

The following are some of the non verbal tests used in India.

(i) Raven's Progressive Matrices Test (1938), revised order (1956) for the student of VIII to XII class.

(ii) Raven's coloured Progressive Matrices for 10 plus and below age group.

(iii) Draw - a man test for Indian children for the age group of 6 to 10 years (Phatak 1966).

(iv) Battery of Performance Tests of Intelligence by Bhatia for the children of 11 to 16 years.

Out of these non verbal tests the researcher found that following tests have been used by Indian researchers at Ph.D. level or for other research investigations.

(i) Draw - a man test used by Bevli (Ph.D. I.I.T. Delhi 1976).

(ii) Raven's Progressive Matrices (Standard) used by Kalra (Ph.D. Jamia Millia Islamia, 1978*).

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*Although the thesis of Kalra was submitted in the year of 1978, but the information of the use of the tests by the said researcher was available at the time of planning of the present study.

(iii) Raven's coloured Progressive Matrices used by Rao (1976).

Use of Draw - a man test and Raven's coloured Progressive Matrices can be considered in this study. Rest of the two tests mentioned above cannot be used with the children aged 10 years or below. As far as the use of Draw - a man test is concerned, from the relevant literature it was found that there would be some amount of subjectivity in scoring and to avoid this risk the idea of using this test was given up.

The other test i.e. Raven's coloured Progressive Matrices Test can be used on the children of 11 years or below. Rao (1976) used this test for assessing intelligence of children aged 4 to 6 years. No norms have been developed for this tool as yet. It appeared to be reasonable that non availability of norms would not be a serious handicap for this study, because this study would be confined to only one age group of children, whose age range would not be more than 12 months. And if the children are of the same or more or less the same age then intelligence score, IQ, percentile score, T Score give similar (if not exactly the same) order of merit. It can safely be assumed that if a test is a good one, raw score and derived scores (IQ, etc.) will show very high correlation.

A Description of the Test

This test was constructed by Raven to "assess as accurately as possible a person's present clarity of observation and level of intellectual development."* The author admits that coloured Progressive Matrices is not a test of general intelligence. The main asset of this test is that it measures a person's ability to form comparision and to reason by analogy as well as the extent the subject is capable of organizing spatial perceptions into systematically related wholes. According to Green & Evert (1947) this test is based on perceptual reasoning. The ability required to solve the puzzles of Coloured Progressive Matrices is independent of acquired knowledge or previously developed verbal skills. This test has been used to measure the intelligence of normal as well as intellectually impaired children.

The Coloured Progressive Matrices Test is in two forms-booklet form and form board. Both the forms have been found to be equally effective.

In this study booklet form was used as it can be easily used with a group of children at a time. There are 36 coloured items. In each item the subject is presented

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*Referred from the manual of 'The Coloured Progressive Matrices' (P. 4).

a pattern with a piece cut out. Below each pattern six pieces are shown. Only one of the pieces can complete the pattern correctly. The subject is asked to choose the right piece out of the six pieces given which would complete the pattern.

The items are arranged from easiest to more complex i.e. at the beginning of the series, the problems are easy to solve, they gradually become more complex requiring more discrimination in making the correct choice hence the task is called Progressive Matrices.

The test-retest reliability has been found to be .90 over the whole range of development for which the test is constructed (Raven, 1947 Manual P. 114).

The assessment procedure and criterion of scoring would be followed as originally introduced by Raven in his Manual.

SELECTION AND CONSTRUCTION OF OTHER TOOLS NEEDED FOR THE STUDY

Before going through the selection and construction of tools based on Piagetian experiments it is necessary to give a brief introduction about the standardization of Piagetian tasks.

Piagetian Tasks and Psychometric Approaches

Piaget is generally interested in knowing about the general forms of thought and the optimum capacity of

it at a given period in the development. He is interested in knowing what is thought process or logical structure behind the action. For this purpose he found the clinical method of inquiry to be the best. The aim of this method is to follow the child's own line of thought without imposing any direction on it. It is the child's answer to a problem that determines the later question to be asked by the experimenter. Only one child can be attended at a time. A situation is presented before the subject in the form of some pattern, story or figure or some concrete situation etc. and then he is asked questions. If the subject cannot follow the question, again the some question is asked in some other way to draw the responses from the subject. By using this clinical method in his studies Piaget could identify the ways a child thinks.

A standardised test is based on the assumption that each subject should be presented with the same problem so that the resultant differences in the performance can be attributed to the differences in the subject's level of development. "Piaget has never bent his talents towards making standardized intelligence tests out of the innumerable cognitive tasks, he has created during his professional life time" (Flavell 1963, P. 361). But since 1959 work is going on in this direction in Geneva itself as well as in other countries. For this purpose Piagetian experiments are converted into test items meeting strict psychometric

criterion but retaining the essence of the original problems. A few of the efforts done in this direction have been listed below:

Tuddenham (1970) attempted to develop a cognitive scale based on Piagetian theoretical formulation.

Goldschmid & Bentler (1968) have considered the important psychometric indices of Piagetian conservation tasks. They used a number of conservation tasks and found the relative difficulty and homogeneity. On the basis of try-out they have developed a scale which they have called "Concept Assessment Kit". Test - retest reliability of the scale has also been found out by these researchers.

Work in standardizing Piagetian tasks is also going on in Social Science Research Council Project under the guidance of Lunzer at Nottingham University.

Winkelman (1975), Gray (1973) have also contributed in the area of standardizing Piagetian tasks.

In India during last five years a number of students of the Faculty of Jamia Millia Islamia University have worked on a project of number readiness test. Parallel forms of a number readiness test have been developed on psychometric model (Bhardwaj 1969, Seth 1973, Nilima 1974).

In summing up it may be stated that though Piaget did not use psychometry, there is no harm in using psycho-

metric models in Piagetian study. However the spirit of Piagetian procedure (clinical interview) should not be diluted.

The present researcher would not go for standardization of any test she would be interested in construction of tests after preliminary tryout of items and item analysis. An indication of reliability of tools would also be found out.

MEASUREMENT OF EGOCENTRISM

A number of researchers like Shantze & Watson (1971), Chandler & Greenspan (1972), Garner & Plant (1972), Fishbein et al. (1972), Borke (1972), Hay (1974), Eliot & Dayton (1976), Urberg et al. (1976) have considered, only measurement aspect of egocentrism in their researches. Different types of tasks and stimuli have been used in the measurement of this characteristic. Egocentrism has been studies in terms of role - taking. The tasks used in these studies can be classified in two groups:

(i) Tasks dealing with subject's ability to predict others cognitive responses. In other words his ability to take up another person's position and give response to a situation from the point of view of the other person.

(ii) Tasks dealing with subject's ability to describe and predict how an observer views something in the

perceptual sense from a perspectives other than the subject's own. Hence the emphasis is on the description of visual perception of another fellow who is observing a concrete perceptual situation in space from a position different from that of the subject.

In this present study only the second type of tasks will be used. According to Flavell et al. (1968, P. 55) performance on such tasks may be taken as "Perceptual role taking" of the subject which means ability to take the role of another person by giving perceptual description* or comment on visual perceptual situation on his behalf. The subject is not supposed to state what he sees, but is required to infer (or predict) what other fellow placed in a different position and looking at a perceptual situation will find or observe.

Inability to respond correctly in such tasks is due to egocentrism, as situations are visual perceptual egocentrism of this type may be called spatial egocentrism of the subject. It may be said that the score on such tasks gives a negative indication of spatial egocentrism. Rubin (1973) have used this type of tasks for the measurement of spatial egocentrism.

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*This may be done either orally by performing some arrangement with objects, or by giving a picture representation.

Description of Tasks used by Flavell et al.**

In one of the classical studies of egocentrism Piaget and Inhelder (1956) have used visual perceptual task which have been described by other workers in the field as'three Mountains experiment'(Garner & Plant, 1972 Borke 1975, Walker & Collin, 1977). Detail of this task is given in the Appendix (I). The task used by Flavell et al. (1968), has been developed on the principles of Piaget's "Three mountains task".

Flavell et al. have constructed 4 displays ordered in a series of increasing difficulty. On the basis of try-out of this task they found that youngest subjects had little difficulty in reproducing the observer's view on the easiest display while only a few of the 17 years old subjects could reconstruct the most difficult display, from another observer's stand point.

Rubin (1973) used this task to measure spatial egocentrism of the subjects whose mean ages were 67.35, 91.30, 116.40 and 138.95 months. So this tool appeared to be applicable on a wide age range group of subjects. Flavell et al. (1968) have given objective criteria for

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*Task IC of Flavell et al. (1968, PP. 55-70).

the scoring of the responses. The interjudge reliability was found as .98. Considering these points it was felt that the task could be used in this study. However it was decided that at first a tryout would be made to find the suitability of the task .

This test consists of four displays ordered in the following manner:

__Display 1__

This display consists of a blue - coloured block of wood, 6" long and 1" thick. It is 6" high at one end and 4" high at the other end to be its upper edge diagonal to the ground.

This block is always placed in such a way that its higher side (H) should be on S's right and lower side (L) on his left, as he faces the model.

__Display 2__

This display consists of three wooden blue Cylinders each 4" in height and 1" in diameter.

These cylinders are presented before the children by standing them on their end in the spatial arrangement as shown in the figure 1.

__Display 3__

This display also has 3 Cylinders of the same diameter as of display 2. However each cylinder differs

in its height. The highest cylinder (H) is 6" the lowest Cylinder (L) is 2" and the middle cylinder (M) is 4" high.

The spatial arrangement in the configuration of Display 3 is shown in the figure 1.

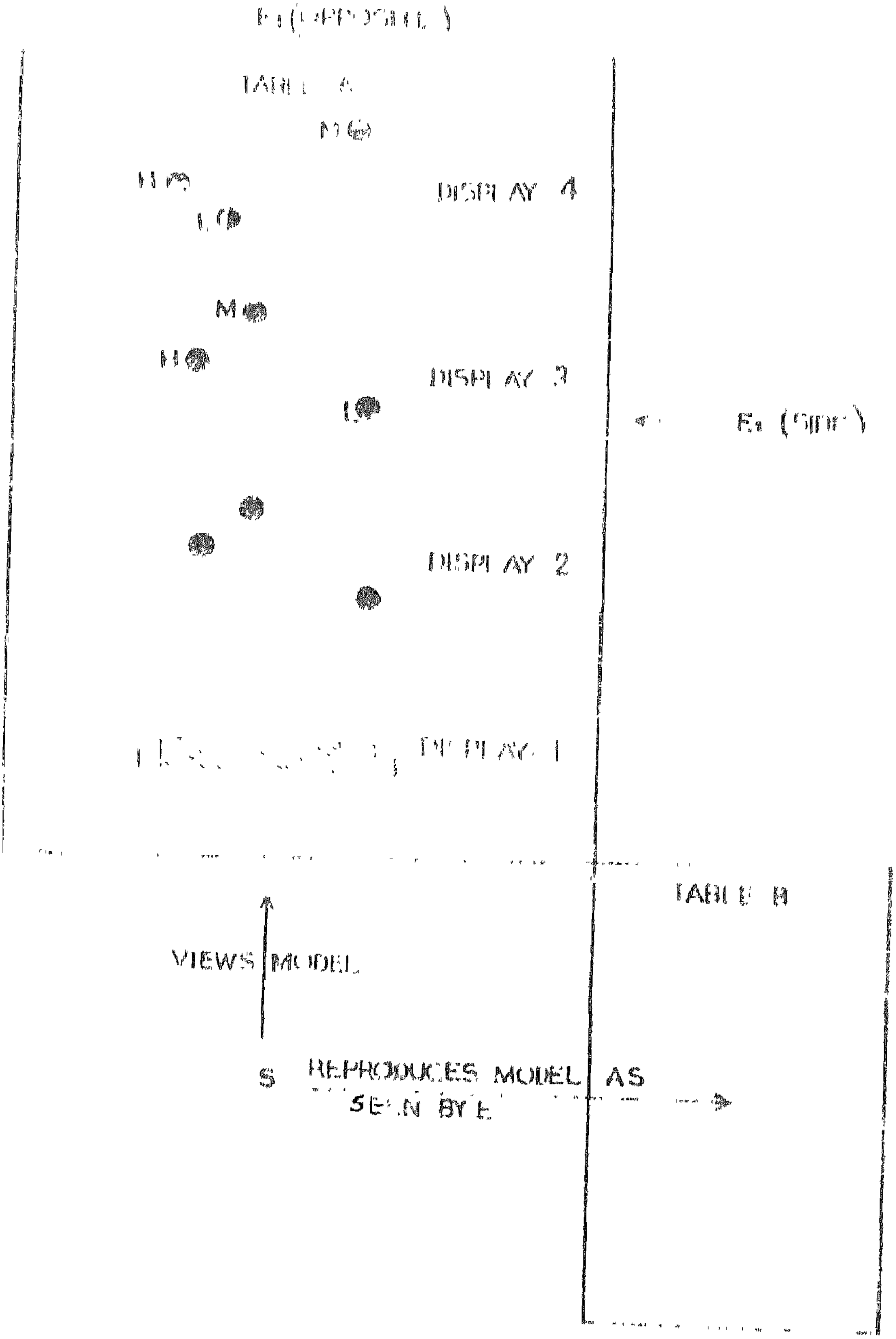
Display 4

This display is also consisted of 3 Cylinders identical in diameter and size as those of Display 3. Half of the circumference of each cylinder including its bottom and top is painted red.

The spatial arrangement of these cylinder in the configuration of Display 4 is shown in figure 1. As far as the arrangement of each cylinder in terms of colour is concerned from his initial position the subject can see the whole white portion of middle cylinder (M) and whole red portion of low cylinder (L) and equal portions of both colours of high cylinder (H).

According to Flavell et al. "The four displays form an ordered series in terms of apparent difficulty" (1968 P. 56). From the above account it can be noticed that each succeeding display places an additional demand on the subject by adding a new feature that has to be taken into consideration while trying to reproduce the perspective of other observer.

Display I is the easiest which involves only one object. The subject is supposed to rotate only one object



: TASK 10 - EXPERIMENTAL SITUATION (VIEWED FROM ABOVE).
(REPRODUCED FROM FLAVELL et. al. 1968, P. 56).

until his perception of it matches to the observer's perception of the display viewed from the position other than the subject's own.

Display 2 is more difficult than the Display 1, since this display deals with spatial pattern and orientation of three identical objects. In order to reproduce the perspective of another person the subject is required to take into consideration the configuration. In this configuration each cylinder should be placed in a proper position and correct distance, relative to one another. However any cylinder can occupy any place in the configuration.

Display 3 forms the third set of the series, from the point of view of difficulty level and complexity. This display has all the constraints of Display 2 plus height aspect. Here in order to reproduce the perspective a subject has to take into account all the aspects of Display 2 plus the position of each particular cylinder in the configuration.

Display 4 is the most difficult and complex display among all the displays. This display deals with all the aspects of Display 3 plus colour aspect. Each particular cylinder has its specific position in the configuration in terms of colour.

Procedure

The assessment procedure employed in this study would be the same as that originally introduced by Flavell et al. (1968) and would differ only in two respects: (i) In the experiment of Flavell et al. two persons - E_1 and E_2 were seated in side (180° from the subject) and opposite (90° from the subject) positions respectively. But in this experiment only one persons - the researcher herself acted as E_1 and E_2. (ii) The procedure also would differ in respect of the language of instructions given to the children. In this study instructions would be given in Hindi while in the experiment of Flavell et al. instructions were given in English.

The cylinders of each display were fastened to a small board (11" x 11") to keep their interrelationship constant. After presentation of each display the subject was given a duplicate set of each element and blank sheet of paper size of which was same as of board. Two tables are needed: Table A on which the model is presented and Table B on which the subject has to reproduce the other observer's perspective. Arrangement of these tables have been shown in figure 1. First the observer sits at the side position (as shown in figure 1) and then researcher places the model of Display 1 in the centre of Table A and lays its duplicate element and blank sheet of paper on Table B and the instruction to the subject is given

(instruction of Hindi version is given in Appendix ( ). The English version of the instructions are given below:

"Look, there are two tables. We will play a game on these tables. This table (Pointing to Table A) is mine and that table (pointing to table B) is yours. On my table there is a model which I am seeing carefully from my place. On your table there is a similar block and a piece of paper. Listen carefully what I say and tell me back what you are expected to do." After this the main instruction is given. "You put your block on the given sheet on your table in such a manner that it looks to you from your place just like the model on this table (pointing to the Table A) looks to me". After completing the instruction the subject is asked "Now tell me what I have asked you to do?" If the subject is not able to tell what he has to do, the same instruction is repeated and then he is asked to do what he has been expected to do. If the child still makes incorrect response on the first attempt, he is asked to walk over to the observer's position and is instructed "see how the model is looked from this place/side". As this model looks from this place, you put your block so that it looks from your place side in the same manner. Go to your place and do it." If upon returning he still fails to orient the block, researcher does it for him explaining why it is correct. Then experimenter moves from side to opposite position (face to face with the

subject) and the same instruction is repeated. If the child makes a correct response in the case of side position and fails when observer sits on the opposite position, he is sent to the observer's position and is given second chance as described above. This second change should be given only once in whichever condition the failure occurs first. Only in the case of Display 1 this second chance is given. Then Display 2 is presented and the same instruction and procedure is followed. At each new presentation the same instructions are to be repeated except in the cases when researcher is sure that the child is not going to forget what he is required to do.

Recording of the Data

As soon as the subject finishes a given arrangement, researcher quickly traces around each element and marks other necessary notations whenever is needed regarding position, height and colour etc. on the sheet of paper on which subject has arranged his duplicate set of elements of each display.

The symbols which would be used in recording of data may be stated as Below:

H = High
M = Middle
L = Low
C = Colour

To show the colour aspect, first a circle is drawn around each cylinder and then each circle is divided in equal halves, according to the coloured and white portion of that cylinder. Letter C is written in the half portion occupied by the coloured portion of the cylinder.

PRE-TRYOUT OF THE TASK

One of the necessary steps in test construction is the pre-tryout. It helps in the improvement of language and materials of the test according to the comprehension level of the subjects. It is the pre-tryout during which procedure and instructions are shaped for the final testing. If the subjects during pre-tryout do not follow the meaning of the words used in the instructions or if they are not similiar with the materials the researcher makes some modifications in those direction.

The directions of egocentrism (Flavell's task 1968) were translated and given to the two experts in the field of test construction who were also proficient in Hindi language to get them checked. For the purpose of pre-tryout all the 4 displays were administered on 10 children - 5 aged 9 years and 5 aged 10 years. They were selected from a Municipal Corporation Primary Boys School. It was found that very slight modification of the language was needed. This was done before using the task in the tryout.

TRYOUT OF THE TASK

Every test constructor goes for tryout for checking suitability of test. At this stage the researcher generally selects a sample of subjects more or less similar to the subjects for which the test is to be constructed. On the basis of tryout of data item analysis is done. Two indices are needed one is difficulty value and the other is discrimination power.

It seems from the book of Flavell et al. (Development of Role - Taking and Communication Skills in Children P. 55-70). That they have not specifically considered difficulty value of different tasks. Also they have not considered discrimination power of different displays, rather they have found out whether there is an accent of mean scores on the whole test for grades when grades are considered from the lowest to highest (This can be seen from Table 3, P. 6 Flavell et al. 1968). The results shows that the task on the whole discriminates a higher grade from a lower grade. They have also compared the number of subjects of different grades giving a correct response to a particular display. However both views-view from the side and view from the opposite positions have been considered. It can be seen from Table - 4 P. 64 (Flavel et al. 1968) that there is a general tendency of more subjects from higher grade

correctly doing the task as compared to the number of subjects from a lower grade correctly doing the same. As in U.S.A., where the tryout was conducted, grades are closely related with age, what has been mentioned earlier regarding grades would be correct for age also.

In this study both difficulty value and discimination power of each display would be considered.

Tryout Sample

Subjects of the wide age - rage from 7 to 12 years were selected for the tryout purpose. Subjects of each age group were selected from a particular grade in whichever grade the subjects of that age group were found more than in any other grades. For example proportionately a larger number of children aged 7 years were available in grade 2 than in any other grades. So 7 years children were taken from grade 2 only in the same way 8 years were taken from grade 3 and so on.

These subject were selected from five Municipal Corporation Primary Boys Schools, (out of 11 such schools within walking distance from NIE Campus, 5 schools were selected at random). Children of 11 and 12 years were mostly found studying in VI and VII grades respectively. These grades are available only in the Middle or Higher Secondary Schools. So 3 Govt. Higher Secondary Boys Schools out of 7 such schools (situated within walking

distance or about 2 Km. from NIE Campus) were selected. All these schools come under New Delhi South Zone.

From each 5 primary schools 4 children were selected at random for each age group 7-10. For 11 and 12 year groups 6 or 7 children were selected from each Higher Secondary School. In this way 20 children were selected at randome for each age group. Age wise, grade-wise distribution of subjects covered by the tryout has been shown in Table 1.

TABLE - 1

Age-wise grade-wise and School-wise Distribution of Tryout Sample

Grade	Age (Yrs.)	Types of the School	Number of Subjects
II	7	M.C. Primary Boys School	20
III	8	"	20
IV	9	"	20
V	10	"	20
VI	11	Govt. Higher Secondary School	20
VII	12	"	20
Total			120

Administration of The Task

The tasks were administered following the procedure given in this chapter earlier. Instructions were given in Hindi. See Appendix (II) for the instruction of Hindi Version. One subject was tested at a time. All the four displays were administered in the same order and in one sitting.

The same procedure as given earlier in this chapter was followed for recording the data.

Scoring

Obtained data was in the form of sheet of papers on which the recording of the subject's arrangement of different display for reproducing the perspective as seen by an observer from side and opposite positions were done. For each subject there were 4 x 2 = 8 sheets. (Two response sheets are given in appendix (III) .

Scoring was done with the help of standard sheets of paper which was thin and transluncent. On these scoring sheet the tracing of exact arrangement of elements (Cylinder/block) was done. Four such sheets were prepared to score 4 displays. This standard sheet was superimposed over the subjects record to compare the obtained tracings with this standard sheet. For the scoring of each display, the respective standard sheets were placed

over the subject's sheets from four perspectives - subject's position, opposite position, side position and other position. If the scoring was being done for the opposite side of any display it was scored correctly only in the case if the subject's arrangement resembled the opposite perspective more than the other three perspectives. According to Flavell et al. (1968) it is not necessary to be called an arrangement correct if it is exactly the same replica of what observer sees from a particular position. A subject's arrangement is taken to be correct if it matches observer's perspective more than any one of the other three. This "best fit strategy" was followed not only in the case of configuration but also in the other aspects of a display. For example in the scoring of Display 3 if the front to back or right - to left (or both) order of cylinders matches the observer's perspective more than any other three perspectives, the arrangement was scored correct. The same strategy was also followed for the colour aspect of Display 4.

Flavell et al. (1968) have devised the scoring system based on the two main assumptions noted below.

1. A sucess on a more complex and demanding display task should be given more weightage than success on a less complex and demanding one. So the maximum scores for Display 1,2,3 and 4 are 3, 4, 5 and 6 respectively.

2. Different levels of degrees of success within each task can be defined on at least semilogical basis. An egocentric arrangement reproducing subject's own point of view shows less evidence of role taking than any other incorrect responses so it should be scored as zero.

Flavell et al. (1968 P. 59) have given the following scheme for scoring responses of the subject on the four displays.

Display 1*

Side position

3. configuration correct on first attempt

2. incorrect on first attempt, but correct on second attempt (that is, after going over to look from E_2's position).

0 incorrect on first attempt, and the second arrangement is the egocentric, S-perspective one.

1 incorrect on first attempt, and the second arrangement is any other incorrect one.

Opposite position

where S had "used up" his second attempt in the previous subtask:

3 correct

1 miscellaneous (that is, incorrect but non-egocentric)

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*Reproduced from the book of Flavell et al. (1968 P.59-60).

0 egocentric

where S still had a second attempt available to him:

3 correct on first attempt

2 correct on second attempt

1 miscellaneous on second attempt

0 egocentric on second attempt

Display 2 (both subtasks)

4 configuration correct

1 miscellaneous

0 egocentric

Display 3 (both subtasks)

5 both configuration and height correct

4 configuration correct, L cylinder properly placed, but M and H cylinders incorrectly placed, relative to each other, on either the right-left or the front-back (or both) dimensions.

3 configuration correct but height "more incorrect" than in 4

2 configuration incorrect but height correct or partly correct (that is, correct ordering of cylinders on either right-left or front-back dimensions, but not both).

1 miscellaneous

0 egocentric (both in configuration and in height)

Display 4 (both subtasks)

6	configuration and colour correct, and height at least partly correct
5	configuration correct, height at least partly correct, but colour only partly correct (i.e., only two of the three cylinders properly oriented as regards colour).
4	configuration correct, and either height or colour (not both) at least partly correct.
3	Either of the following: (a) configuration correct but neither height nor colour even partly correct, (b) configuration incorrect but both height and colour at least partly correct.
2	configuration incorrect, but either height or colour (not both) at least partly correct.
1	miscellaneous
0	egocentric (in configuration, height, and colour)

ITEM ANALYSIS

In item analysis a psychometrician considers two aspects. Difficulty value of an item and its discrimination value.

Difficulty Value

If the item is too difficult or too easy, it should not be included in a test. Generally range of difficulty is arbitrarily fixed and taken as an acceptable range. If a test author takes 15% to 85% as permissible range of difficulty value, then any item showing a value in this range is considered to be a suitable item on the basis of this criterion.

When only two responses (correct or incorrect) and hence two scores (1 and 0) are possible on an item, calculation of the difficulty value is a very easy task. But when three or more responses and hence three or more scores are possible on an item the job becomes slightly difficult. In the test under consideration responses of all the displays could be scored in 4 to 7 different manners. For instance in Display 1 a subject could score 0, 1, 2 or 3 and in Display 4 he could score 0, 1, 2, 3, 4, 5, or 6. So to find out the difficulty value of each display of this task it was decided that total score of different subgroups on a display would be calculated and it would be expressed as a percent of the total score possible on that display and this would be taken as an index of difficulty. The responses, given by different subjects were scored as per direction described earlier in this chapter.

For each display index of difficulty was calculated separately for two positions; Side and opposite, have been shown in the following tables.

Total scores of different subgroups on different displays and index of difficulty of different displays have been shown in Tables 2a, 2b, 2c and 2d.

TABLE 2a

Scores of different age groups on Display 1 (Layout)

Age	7 years		8 years		9 years		10 years		11 years		12 years	
Positions	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.
N	20	20	20	20	20	20	20	20	20	20	20	20
Total Scores	33	14	45	17	50	31	51	28	58	44	60	59
Total possible Maximum score	60	60	60	60	60	60	60	60	60	60	60	60
Total scores expressed as % of total possible score	55.00	23.33	75.00	28.33	83.33	51.67	85.00	46.67	96.67	73.33	100.00	98.33

TABLE 2b

Scores of different age groups on Display 2 (Tryout)

Age	7 years		8 years		9 years		10 years		11 years		12 years	
Positions	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.
N	20	20	20	20	20	20	20	20	20	20	20	20
Total Scores	11	15	25	16	39	39	37	40	38	46	47	53
Total possible Maximum scores	80	80	80	80	80	80	80	80	80	80	80	80
Total scores expressed as % of total possible	13.75	18.75	31.25	20.00	48.75	48.75	46.25	50.00	47.50	57.50	58.75	66.25

TABLE 2c

Scores of different age groups on Display 3(tryout)

Age	7 years		8 years		9 years		10 years		11 years		12 years	
Positions	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.
N	20	20	20	20	20	20	20	20	20	20	20	20
Total Score	8	13	20	16	33	38	45	45	45	41	53	46
Total possible Maximum scores	100	100	100	100	100	100	100	100	100	100	100	100
Total score express as % of total possible score	8.00	13.00	20.00	16.00	33.00	38.00	45.00	45.00	45.00	41.00	53.00	46.00

TABLE 2d

Scores of different age groups on Display 4 (Tryout)

Age	7 years		8 years		9 years		10 years		11 years		12 years	
Positions	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.	Side	Opp.
N	20	20	20	20	20	20	20	20	20	20	20	20
Total Score	16	16	21	20	31	32	53	37	58	38	58	45
Total Possible	120	120	120	120	120	120	120	120	120	120	120	120
Total score Express as % of total possible score	13.33	13.3	17.50	16.67	25.83	26.67	44.17	30.83	48.33	31.67	48.33	37.50

The permissible range of difficulty was arbitrarily taken as 15% to 85% i.e. the item should not be so difficult that less than 15% of the population could do it and it should not be so easy that more than 85% of the population could do it.

From table 2a it can be seen that for the side position of Display 1, the index of difficulty ranges between 55% to 100% for different age groups. This display appeared to be too easy for the subjects aged 11 and 12 years. For the opposite position of the same display only 12 year group found it too easy. So from the point of view of index of difficulty for the side position, Display 1 is suitable for 7 to 10 year old subjects and for the opposite position, this display is suitable for 7 to 11 years old.

Table 2b represents the picture of the index of difficulty of Display 2. This display is suitable for all age groups except for 7 year old who found it slightly more difficult (14%) in the side position.

Regarding the index of difficulty of Display 3 and 4 it can be seen from Table 2 (c) and Table 2 (d) that both these display seemed to be difficult for 7 year old children for both side and opposite position. For the rest of the age group of subject both side and

opposite subtasks were found to be suitable from the index of difficulty point of view.

In summing up it can be stated that from the stand point of index of difficulty for the side and opposite position all the four displays are suitable for the age 8 to 10.

Discrimination Value

Psychometricians have used a number of methods for calculating the discrimination value of test items. One of the criteria used in calculating the discrimination value of an item is that the item should discriminate between a good scorers and a bad scorers. If the answer of an item is either correct or incorrect (Scored as 1 and 0) then calculation of such indices of discrimination as upper and lower index, biserial correlation, phi-coefficient etc. are easy. If in a scoring system more than two scores on an item is possible, calculation of discrimination value becomes a difficult task.

In this tool for each display more than two scores are possible for each subtask (side and opposite positions). For instance for Display 4 the possible range of score is 0-5, so it was thought that in this situation a simple procedure may be followed for checking discrimination value of a display. This was done by comparing the responses of

different age groups separately for each subtasks of each display. According to Piaget with increase in age the cognitive functioning also becomes more and more mature. It can be argued that 8 year subjects should do better than 7 year subjects, on any Piagetian task, provided the sampling was done more or less in the same manner for both age groups. In order to have a cleare indication of this trend a slightly bigger age range was taken. For this purpose the 6 age groups were regrouped as three age range groups:

(i) 7-8 years
(ii) 9-10 years
(iii) 11-12 years

Scores of each age group have been shown in Table 3a, 3b, 3c, and 3d.

TABLE 3a

Scores of the Different age Groups on Display 1

Age groups →	7-8	9-10	11-12
Side position	78 (1.95)*	101 (2.53)	118 (2.95)
Opposite position	31 (.78)	59 (1.48)	103 (2.58)

*Figures within brackets indicate mean score

TABLE 3b

Scores of Different Age Groups on Display 2

Age groups	7-8	9-10	11-12
Side position	36 (.90)[*]	76 (1.90)	85 (2.13)
Opposite position	31 (.78)	79 (1.98)	99 (2.48)

TABLE 3c

Scores of Different Age Groups on Display 3

Age groups	7-8	9-10	11-12
Side Position	28 (.70)	78 (1.95)	98 (2.45)
Opposite position	29 (.73)	76 (1.90)	87 (2.18)

TABLE 3d

Scores of Different Age Groups on Display 4

Age groups	7-8	9-10	11-12
Side position	37 (.93)	84 (2.10)	116 (2.90)
Opposite position	36 (.90)	69 (1.73)	83 (2.08)

[*] Figures within brackets indicate mean score

The data have been represented on bar graphs. Two bar graphs - one for side and the other for opposite positions, were prepared for each display. From Figures 2, 3, 4, 5, 6, 7, 8 and 9 it can be easily seen that there is a steady order of accent of success with increasing age. Better responses had been given by older children. Flavell et al. (1968 P. 61, Table 3) have also found a similar trend. The mean scores of different age groups showed a general trend of better responses with higher grade* (hence higher age).

It can be concluded that from the stand point of discrimination power all the subtasks are suitable for inclusion in a scale meant for 7 to 12 year subjects.

Result of this tryout indicated that the task of Flavell et al. (1968) could be used as such with their experimental and scoring methods. If individual differences is to be considered it would be better to restrict the study in the age range 8-10 because all the subtasks showed appropriate difficulty values in these age groups.

Choice of the Age for the Study

In the first chapter it has been stated that this study would be confined to only one age group. According

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*The question of age and grade relationship in America has already been discussed in this chapter.

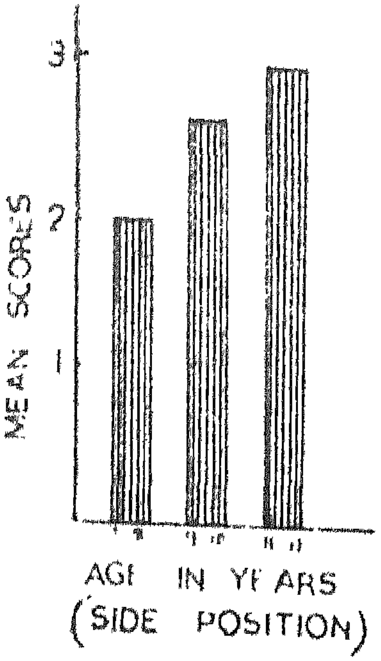


FIG. 2 : MEAN SCORES OF THREE AGE GROUPS ON DISPLAY-I

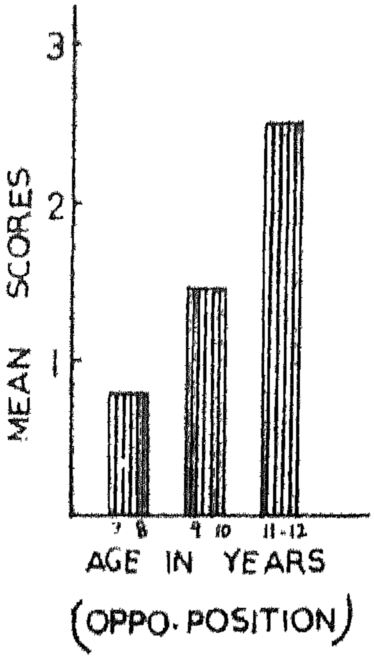
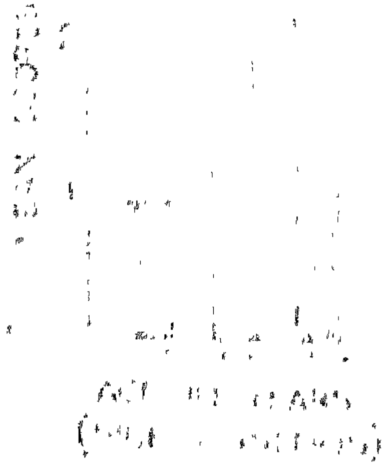
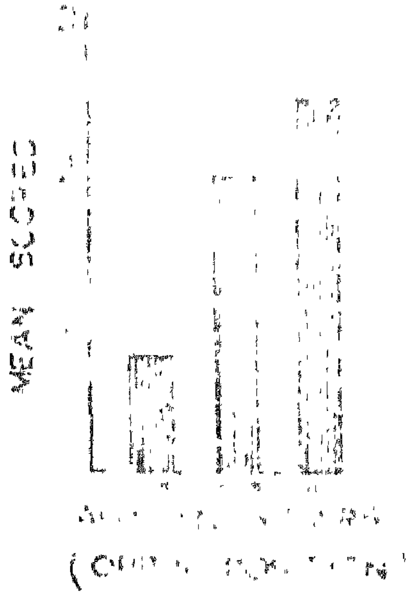


FIG. 3 : MEAN SCORES OF THREE AGE GROUPS ON DISPLAY-I



[illegible]



[illegible] MOVES ON DISPLAY 2

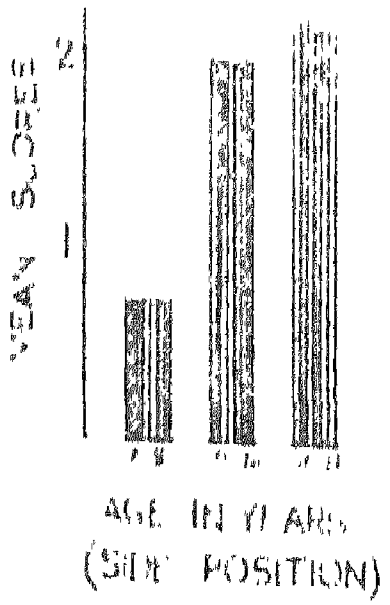


FIG. 6: MEAN SCORES OF THREE AGE GROUPS ON DISPLAY 3

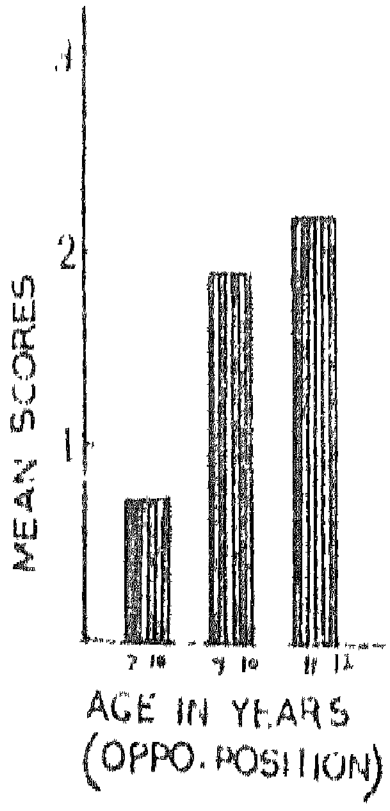


FIG. 7: MEAN SCORES OF THREE AGE GROUPS ON DISPLAY - 3

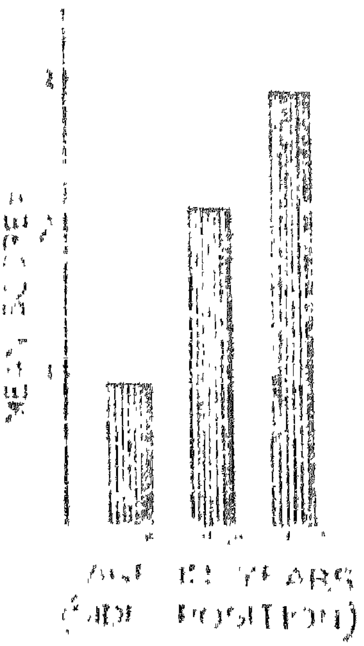


FIG. 8 :MEAN SCORES OF THREE AGE GROUPS ON DISPLAY-4

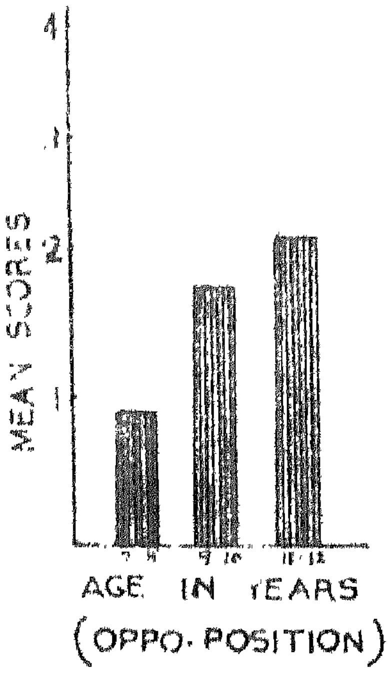


FIG. 9 :MEAN SCORES OF THREE AGE GROUPS ON DISPLAY-4

to psychometricians if individual differences is to be considered it is better to have an average difficulty level of a test as a whole near 50 percent. It is assumed that if the average difficulty value of the test is 50 percent or near it the test would show better differentiation between subjects, in other words, more wide range of variations of responses can be detected with such test. Before choosing the age in which the main study is to be conducted total scores and mean scores of each sub-group - 8, 9 and 10 years (for whom the task was found suitable) were calculated. The mean score was expressed as a percent of total maximum scores. These measures (percentages) were taken as an indication of the difficulty of the test as a whole. Table 4 shows the same.

TABLE 4

Mean Scores on the whole Task (Spatial egocentrism) of 3 age groups

Age	8 years	9 years	10 years
Mean scores	9.00	14.80	16.30
Mean scores expressed percentage of the total possible score	25	35.55	45.27

It can be seen from Table 4 that for the age group of 10 the difficulty level of the task as a whole is 45% (not much different from 50%) whereas in other age groups the difficulty level on the whole was less than 45 percent (25 percent for 8 year and 36 percent for 9 year). Hence it was decided that the test could be used with the age group 10.

RELIABILITY OF THE TASK

One of the ideas behind reliability is to see stability of consistency of obtained scores on a test. If the same subjects obtained same scores on a test if it repeated on two same occasions it can be stated that particular test is reliable.

The other form of reliability is related to the scoring technique. Here the psychometricians' main concern is to see whether the responses of the same subjects are assigned the same scores if given to different judges. This type of reliability is termed as interscores or inter-judge reliability, and is only required when scoring techniques is susceptible to subjectivity. In the case of this tool both forms of reliabilities were calculated.

Reliability . (Stability)

For the calculation of reliability (stability) of the tool test-retest method was used. 30 subjects

aged 10 year (grade V) were taken from 5 Municipal Corporation Primary Boys Schools. These subjects were tested twice giving a gap of about one month between the two administrations. The raw data of test and retest is given in Appendix (IVa). Sparman rank correlation coefficient (rho) was calculated between the two sets of scores. As there were quite a few ties, rho was corrected for ties (Sigel, 1956, formula 9.4, P. 210). It was found to be .82. This tool may be fairly taken as stable. It may be mentioned here that Flavell et al. (1968) have not reported any coefficient of stability.

Inter-Scorer Reliability

Scoring should be objective, in other words if two scorers evaluates test performance of a particular subject they should give the same score. Inter scorer relaibility is found to answer the question, how objective is the scoring procedure. Response sheets of 30 subjects which were used for the calculation of test-retest reliability (first testing) were given to a research scholar* for scoring. She had completed a Ph.D. project in the Field of cognitive development and had a sound knowledge about Piagetian theory. The two sets of scores (raw scores)are given in Appendix (IVb), were correlated by the same method as in the case of test-retest reliability

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*K. Bharti. Junior Project Fellow, Child Study Unit,

Rho corrected for ties was found to be .95.** This indicates that scoring procedure is highly objective (The researcher could not find any other suitable person for scoring the responses. If three or more sets of results were available, Kendal's index of concordance could have been calculated).

[illegible] OF CONSERVATION

Piaget's classical experiments on conservation mostly involve two objects equal*** in some attribute. Then conflict is created in a situation when one of the objects (variable stimuli) that has been judged equal in some attribute (number, length etc.) to a comparison object (standard stimuli) is made to undergo a transformation (e.g. changing the shape), so that it looks different from the comparison object. After the transformation the subject is asked whether both the objects are the same regarding the attribute which was the same before transformation, or any one of them is more or less in that attribute. After Piaget, a number of researchers have developed a large number of tasks for assessment of conservation.

**Flavell et al. (1968) have found the inter-scorer reliability of this tool as .98. The coefficient obtained in this study compares favourably with the coefficient of Flavell et al.

***He has used a few experiments in which inequal objects were taken and conservation of inequality was investigated.

Classification of Conservation Tasks

According to Elkind (1967) there are two types of tasks each assessing a different type of conservation: conservation of identity and conservation of equivalence. To assess conservation of identity, a single object is shown to the subject before and after the transformation of the shape of that object. After making transformation, the subject is asked whether that object is the same or it has changed in that attribute. Measurement of conservation of equivalence requires presentation of two objects equal in an attribute. Then one of the objects is changed in respect to some other attributes; and the subject is asked whether both the objects are the same in the attribute which was considered earlier (length, area, number, weight etc.). Elkind found that equivalence tasks are more suitable for assessment of conservation than the tasks of identity conservation. According to Elkind tasks of identity conservation "run the risk of memory falsification leading to pseudo conservation". (Elkind 1967b,P. 467).

Baker (1971) has classified all the conservation tasks into three: (i) operative conservation tasks (ii) figurative conservation tasks and (iii) traditional conservation tasks. In the operative tasks the tradition is to present a single object before, after and during

the transformation of the shape and then the subject is asked the question about its quantitative invariance. This type of tasks seem to measure identity conservation. In figurative type of tasks the subject is presented two objects equal in some attribute but different in forms and then the subject is asked to judge their equality. The traditional conservation tasks include all Piagetian conservation tasks. The common procedure is to present two objects equal or inequal in quantity, then one of the object is transformed in its shape to look perceptually greater, smaller or equal (depending upon the situation) and the question regarding the invariance of quantity is asked. Baker (1971) on the basis of his study concluded that operative and figurative tasks seems to be more difficult than the traditional tasks. The operative type of tasks offer the child insufficient information on the basis of which he can give his conserving or nonconserving response. The figurative tasks can be used for assessing "formal operation". He found that traditional tasks are more suitable for studying conservation at concrete operational stage or at earlier stages.

Conservation tasks can also be classified on the basis of the quantity of materials used in the tasks. (Piaget 1952, Zimiles 1966). Two such types of tasks can be identified (i) First type of task is conservation

of equality in which two equal (in quantity) and similar object is presented. Then one of the object is transformed in shape to appear perceptually smaller or greater than the other one and the question is asked about the invariance of quantity.(ii) The second type of tasks are called conservation tasks of inequality. In these tasks also two objects are used but different in some attribute. Then one of the objects (smaller one or the greater one) is changed in shape to look perceptually equal, greater or smaller than the other object. After this the subject is asked whether the transformed object still retains its former attribute Zimiles (1966) found that both types of conservation tasks were equal in difficulty level and hence equally effective.

Conservation has also been measured with the verbal and nonverbal type of tasks (Mermelstien 1967). Ankney (1975) has constructed a paper and pencil test to assess conservation of different concepts. Performance of the subject on this test was compared with the performance on Piagetian type tasks. It was found that for the measurement of conservation at concrete operational stage, use of the later type of tasks was more suitable than the former one.

Choice of The Type of Tasks For the Study

From the above account it appeared that, for this study traditional Piagetian tasks of conservation of equality and inequality would be suitable. Use of the other type of tasks would not be considered in this study.

Criteria to be Used

The child's ability to conserver have been assessed by several verbal techniques. Mainly three criteria have been used (Piaget, 1952, Pratoomraj & Johnson, 1966 and Peisach & Wien, 1970).

Prediction

Asking the child to predict the quantitative changes that might result from the spatial rearrangement of the object.

Evaluation or Judgment

Asking the child to describe the quantitative changes in object that has been transformed in shape.

Explanation

The child is asked to give reason or explanation for his judgment/ According to Gruen (1966) the choice of criterion used to assess conservation depends to a greater extent on the psychological processes that are assumed to underlie conservation. Variations in the

results obtained by different studies can be accounted on this basis. To quote some of the examples, Brain & Shank (1965) & Bruner (1966), on the basis of their studies, found that concept of conservation develops in children at the age of 4 or 5 years. Smedslund (1961) presents somewhat different picture of the development of conservation of concepts. According to her the child does not have the ability until he reaches the age of 7 years or so. This finding agrees with that of Piaget. It has also been supported by other studies. The main reason behind this disagreement of the results obtained by these studies lies in the fact that different criteria for assessment of conservation have been used. Bruner labelled a child to be a conserver or a non-conserver on the basis of evaluation or judgment responses only. According to him explanation is not a necessary part of conservation. He is of the view of that an inappropriate explanation does not show the absence of logical operation but it is merely an indication of the child's lack of verbal skills.

But Piaget and Smedslund do not rely on the simple symptom response (judgment or evaluation). Explanation criterion should also be taken into consideration. Explanation are essential evidence of conservation. Smedslund (1963) finds the significance of explanation in the assessment of conservation in two ways: (i) it yields

higher correlation than the symptom response alone with certain addition/substraction operations and (ii) it is also significant in being more predictive than the symptom response alone of resistance to extinction.

As far as the choice for criteria for the present study is concerned, both judgment and explanation would be used. As it has already been mentioned (in chapter I) that logical processes like reversibility, compensation etc. underly conservation. These processes can only be manifested through the explanation given by the subjects. Hence the researcher considered explanation criterion to be important for the present study. Piaget et al. (1960) have not used the criterion of prediction in assessing the conservation of length and conservation of area. Since the present study is also concerned with the assessment of these two, so the criterion of prediction would not be considered in this study.

Importance of Transformation in the Conservation Tasks

All conservation tasks involve transformation. According to Piaget "In physical reality there are states, and in addition to these there are transformations which lead from one state to another ... In children of the higher stage and in adults ... any given state is understood to be the result of some transformation and the point of departure for another transformation. But the

pre-operational child does not understand transformations. He does not have the operations necessary to understand them so he puts all the emphasis on the static quality of the states. It is because of this, for example, that in the conservation experiments he simply compares the initial state and the final state without being concerned with the transformation" (Piaget, 1964, P. 20).

According to Feigenbaum (1963) and Goldschmid (1967) number and type of transformation affect the response of a subject on the conservation task. For example if two equal balls of clay are shown to the child and the comparison of one of the balls by transforming it into a Sausage or pancake or two or three balls with the standard ball (s) will bring some variation in the response of the child. Even the length of the transformed Sausage affect the judgment on the conservation tasks. So transformation has its important place in the conservation tasks.

Piaget (1960) has described different types of tasks for assessment of conservation of length and conservation of area. He has made different transformation in these tasks. Mainly two types of transformation could be identified from his tasks:

(i) Transformation by change of position of the object.

(ii) Transformation by distortion of shape of the object.

These transformation will be used in the construction of conservation tasks of length and area.

Choice of Materials

Lester & Klien (1973) demonstrated that familiarity of stimulus affect the performance on conservation tasks. So only familiar objects would be used in these tasks. An Indian child is supposed to be familiar with such thing as pencil, wire, rods, threads, cow, grass land etc. Tasks were prepared by using such materials only.

All the tasks of conservation of length and conservation of area were selected from the studies of Piaget et al. described in his book 'Child's Conception of Geometry'. Only very few modification were made in regard to materials used by these researchers. Mainly all the tasks can be discribed under two headings -

(i) Tasks of equality of conservation.
(ii) Tasks of inequality of conservation.

Tasks of equality of Conservation

As stated earlier in this type of tasks two similar objects, equal in quantity were taken. One of the object was transformed to look greater or smaller than the another object. Then judgment or evaluation and explanation questions were put.

Tasks of Inequality of Conservation

The general practice of constructing the inequality tasks for conservation is that two objects inequal in quantity are taken. First the subject is assured that both objects are not equal in quantity. Then either smaller or greater object is transformed. If the transformation is to be made in the smaller object then the effort of experimenter is to transform it in such a way that it should appear greater than the other object. And if the greater object is to be transformed then the attempt is made to transform the shape of that object to look smaller than the other object.

Both types of transformations would be made in these conservation tasks.

Collection of Items

Tasks of conservation of length and area were constructed based on Piagetian tasks (1960). 10 items for conservation of length and 10 items for conservation of area were prepared. Distribution of the items of equality and inequality is given below:-

Tasks of Conservation of Length

1. Conservation tasks of equality - 5
2. Conservation tasks of inequality- 5

Tasks of Conservation of Area

1. Piagetian conservation tasks (of meadows) - 6
2. Conservation tasks of equality - 2
3. Conservation of tasks of inequality - 2

The descriptions of all the tasks of conservation are given in Appendix (V & VI).

Pre-tryout of Conservation Tasks

All the 20 items prepared (10 item for conservation of length and 10 items for conservation of area) were given to two persons who were experts in test construction and were acquainted with the developmental psychology of Jean Piaget. They also had good knowledge of Hindi. They checked the items and suggested some changes which were incorporated.

The pretryout was done on the 10 children (5 aged 9 years and 5 aged 10 years) on whom the pretryout of the tasks of spatial egocentrism was also done. During pretryout it was found that each test required about 30 minutes for administration and so they were administered in two seperate sessions.

To avoid the formation of response set in the subjects, equality and inequality items were mixed together in a random order and administered. All the items were administered in the same order to all the children.

Only in a very few items modifications of language or transformation* were required.

Tryout of Conservation Tasks

The tryout of the tasks of conservation was done in continuation of the tryout of the tasks of spatial egocentrism. Tryout was done on the same group of subjects** (N = 120).

The three tools (tasks of Spatial egocentrism, conservation of length and conservation of area) were administered as done in pre-tryout. At this stage not more than four subjects could be covered in a day. Hence four subjects needed two days (One day for the administration of Spatial egocentrism and another day for the administration of tasks of conservation of length and area). In all about 60 working days were required at this stage.

Recording of the Data

A response sheet*** was prepared for each subject. Evaluation responses and explanation were filled during administration as given by the subjects.

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*For example a straight wire was bent to make the shape of 'Circle' and if it did not work then it was changed into the shape of "S" which served the purpose. See Appendix (V) item No. 5.

**Selection of the schools, age, sample size of the tryout group have already been discussed in this chapter.

***Proforma of a response sheet is given in the Appendix

Scoring

Piaget has not devised any scoring scheme for the responses given by his subjects on conservation tasks. He has never fully considered statistics in the interpretation of the results of his study. As Berlyne States "Except for some means and mean deviations in his reports of perceptual experiments, he provides few statistics. There are generally no measures of variance, which one suspects must be considerable, no test of significance, just a categorial statement that at such and such an age children do such and such with a few specific illustrations" (Berlyne 1957 P. 11).

But a number of researchers (Goldschmid & Bentter 1968, Elkind 1961a,Bat-Haee et al. 1971, Rao 1976aetc.) have followed psychometric approach in analyzing their data obtained on Piagetian conservation tasks. For this purpose they have assigned numerial scores to the responses given by the subjects on different conservation tasks.

Generally two types of scores have been considered by these researchers:

(i) Evaluation or judgment score.

(ii) Justification score.

Evaluation Score

Evaluation questions require the answer in "bigger/ smaller" "equal/unequal" etc. For each correct response

the subject is given 1 point. If the answer is incorrect he is given 0 mark. The same scoring technique would be followed in this study also.

Justification Score

The researchers have generally scored the justification responses on 2 points scale 1 score for correct response and 0 score for incorrect response.

In this study it was found that the children were giving three types or levels of responses. Hence it was thought that scoring of each task out of a total of 3 would be possible and justified. Some of the responses were so ambiguous that neither they could be thought as incorrect nor fully correct responses. So to avoid such practical difficulties, a three-point scale was used for scoring the justification responses. A child giving a correct and satisfactory explanation of his judgment was given 2 marks, whereas a child giving partially correct reasons was given just 1 mark and a child giving no justification or wrong justification a 0. Some of the examples are given below together with their scores:

Conservation of Length Task of Equality Item No. I

The subject was shown two pencils equal in length lying horizontally to the subject on the table with their ends in perfect alignment. Then one of the pencils was

shifted 5 cm. (approximately) toward the right handside of the subject and then the subject was asked judgment and explanation questions.

0 Point

Code No. 5

Judgment: "One pencil is smaller than the other one".

Explanation: "Because you have moved this pencil to this side".

Here both responses were incorrect. So this subject (Code No. 5) was given 0 point for this item.

1 Point

Code No. 8

Judgment: "Both pencils are equal in length".

Explanation: "I don't know".

This subject obtained 1 point for judgment response and 0 Point for explanation response.

2 Points

Code No. 11

Judgment: "Both pencil are equal in length".

Explanation: "Although they seem to be unequal but they would be equal when put together". In this case one point was given to judgment and one point to explanation response.

3 Points

Code No. 1

Judgment: "Both pencils are equal in length".

Explanation: "In the start when you showed these pencils, they were equal in length. As nothing has been added in or substracted from these pencils, they should be equal in length".

One point was given to the judgment response and two points were given to explanation responses.

All the responses obtained from tryout of conservation tasks were scored in the above manner.

ITEM ANALYSIS OF CONSERVATION TASKS

Item analysis was done in the same manner as in the case of the task of spatial egocentrism.

Indices of difficulty and discrimination value were considered at this stage.

(a) Tasks of Conservation of Length

(i) Index of Difficulty

For getting indices of difficulty for each item, total scores of different age groups were expressed as a percentage of the total score possible on the same item or task. The same is shown in Table No. 5. Taking 15 percent to 85 percent as the permissible range of difficulty, it can

TABLE - 5

Scores of Different Age Groups on the Tasks of Conservation of Length

7 years	8 years	9 years	10 years	11 years	12 years
5 (8.33)	6 (10.0)	18 (30.0)	27 (45.0)	46 (76.67)	53 (88.33)
7 (11.67)	14 (23.33)	26 (43.33)	31 (51.67)	40 (66.67)	50 (83.33)
5 (8.33)	5 (8.33)	25 (41.67)	29 (48.33)	38 (63.33)	49 (81.67)
2 (3.33)	1 (1.67)	21 (35.00)	22 (36.67)	33 (55.00)	51 (85.00)
2 (3.33)	2 (3.33)	8 (13.33)	16 (26.67)	35 (58.33)	48 (80.00)
2 (3.33)*	1 (1.67)	2 (3.33)	16 (26.67)	24 (40.0)	41 (68.33)
5 (8.33)	4 (6.67)	11 (18.33)	26 (43.33)	37 (61.67)	47 (78.33)
4 (6.67)	2 (3.33)	13 (21.67	29 (48.33)	38 (63.33)	49 (81.67)
2 (3.33)	3 (5.00)	24 (40.00)	25 (41.67)	36 (60.00)	49 (81.67)
2 (3.33)	2 (3.33)	8 (13.33)	23 (38.33)	33 (55.00)	49 (81.67)

---

within brackets indicate the total scores expressed as
ge.

be seen from the table that all the 10 items were too difficults for 7 and 8 year old children whereas 9 year old children found the item Nos. 2, 9 and 10 difficult. For the age group of 10 and 11 all the items could be taken as suitable from the point of difficult. Item No. 1 was found slightly more easy for 12 year old subjects.

So all the items were too difficult for 7 and 8 year old subjects while for 9 and 12 year old subjects some of items were not suitable. For the age groups 10 & 11 all the 10 items were found to be suitable for inclusion in the final form of the scale from the stand point of difficulty.

ii) Discrimination Value

Discrimination value was found out in the same manner as given earlier in this Chapter. From Table [illegible] total score on 10 items for three age subgroups can be seen. Bar graphs were prepared using mean scores of different groups (Figures 10 to 19). From all the 10 figures or bar graphs it can be seen that mean scores and hence total scores of different age groups are increasing with increase in age. In other words there is a regular ascent of total scores of different age groups with increase in age. So from the stand point of discrimination power all the 10 tasks of conservation of length were found to be suitable for inclusion in the scale.

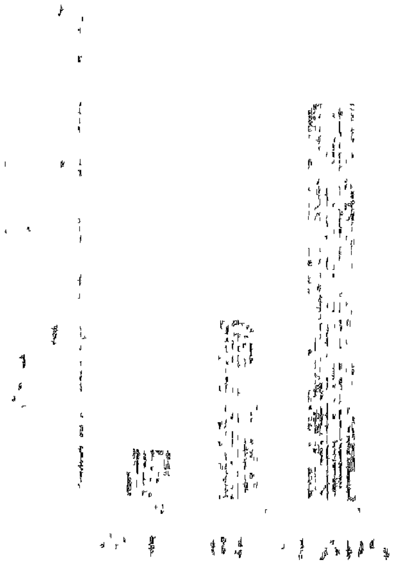


FIG. III : MEAN SCORES OF THREE AGE GROUPS ON ITEM NO. 1 (CONSERVATION OF LENGTH)

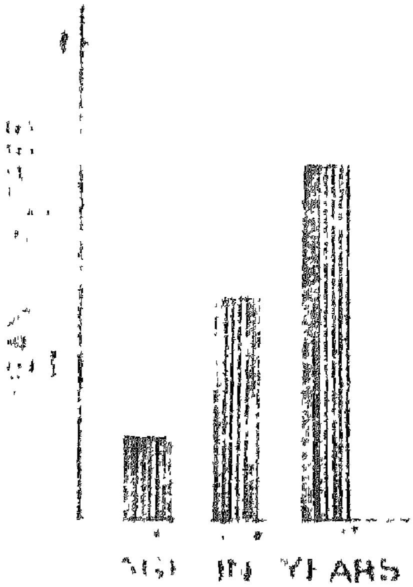


FIG. II : MEAN SCORES OF THREE AGE GROUPS ON ITEM NO. 2 (CONSERVATION OF LENGTH).

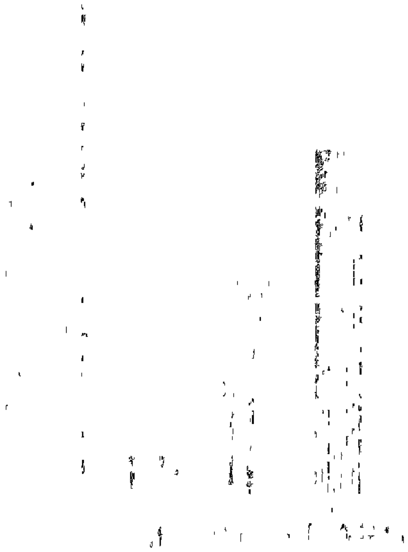


FIG. 12: MEAN SCORES OF THREE AGE GROUPS ON ITEM NO. 3 (CONSERVATION OF LENGTH)

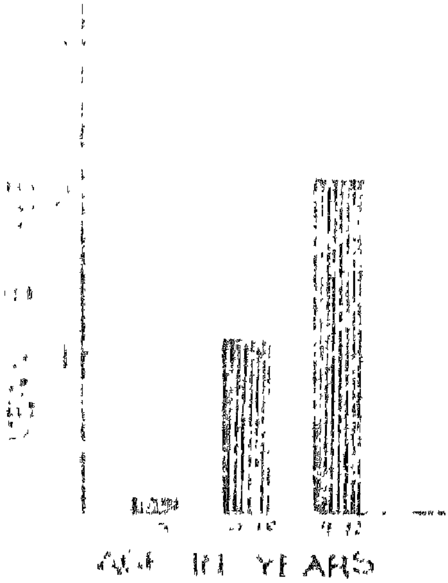
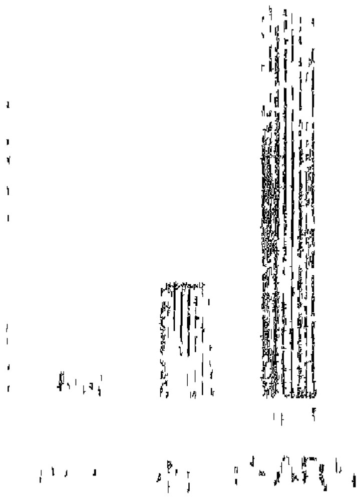


FIG. 13: MEAN SCORES OF THREE AGE GROUPS ON ITEM NO. 4 (CONSERVATION OF LENGTH).

[illegible] THREE AGE GROUPS ON

[illegible] (CONSERVATION OF LENGTH)



[illegible] SCORES OF THREE AGE GROUPS ON

[illegible] (CONSERVATION OF LENGTH)

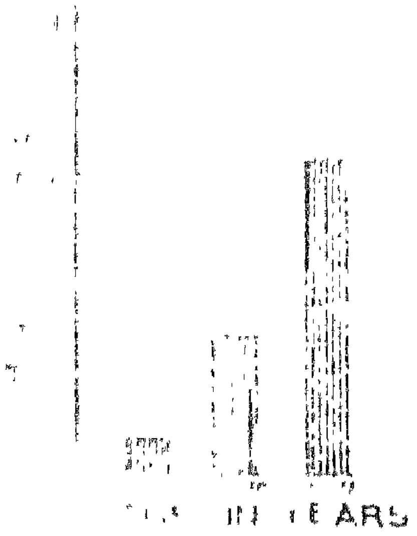


FIG. [illegible] MEAN SCORES OF THREE AGE GROUPS ON ITEM NO. 7 (CONSERVATION OF LENGTH).

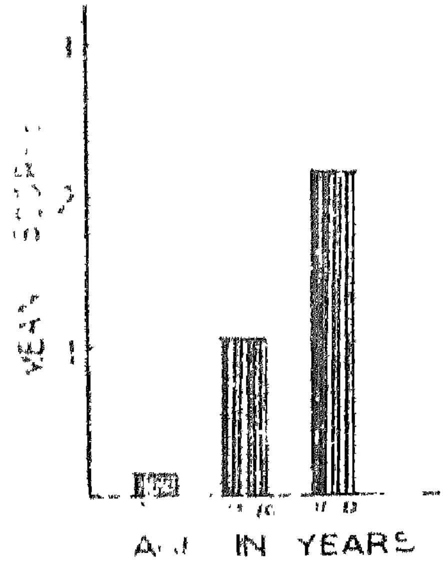


FIG. [illegible] MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 8 (CONSERVATION OF LENGTH).

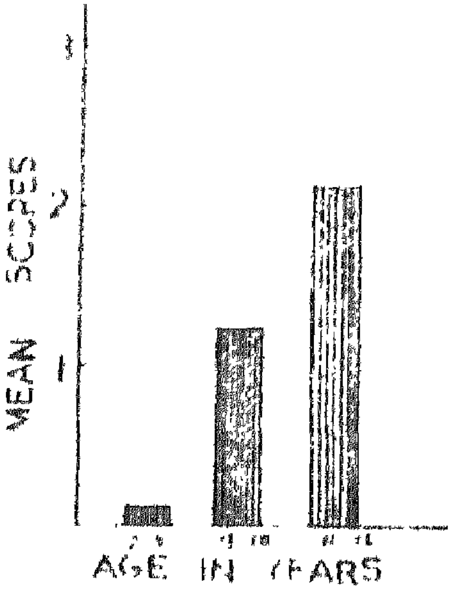


FIG 18 : MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 9 (CONSERVATION OF LENGTH).

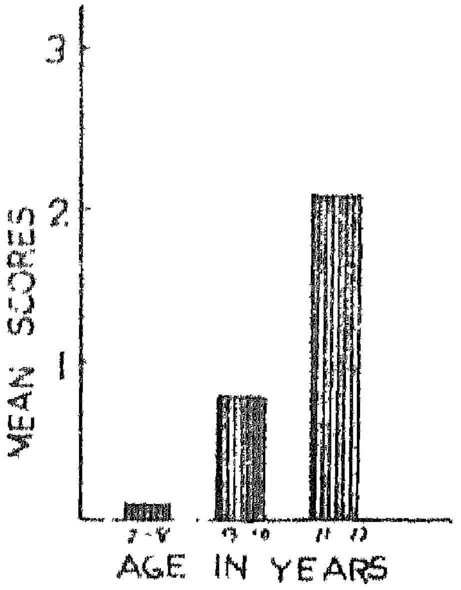


FIG 19 : MEAN SCORES OF THREE AGE GROUPS ON ITEM NO.10 (CONSERVATION OF LENGTH).

TABLE - 6

Scores of Different age groups on the Tasks of Conservation of Length

Age	7-8	9-10	11-12
No. of Subject	40	40	40
Item No.			
1	11(0.18)*	45(1.13)	99(2.48)
2	21(0.53)	57(1.43)	90(2.25)
3	10(0.25)	54(1.35)	87(2.18)
4	3(0.08)	43(1.08)	84(2.10)
5	4(0.10)	24(0.60)	83(2.08)
6	3(0.08)	18(0.45)	65(1.63)
7	9(0.22)	37(0.93)	84(2.10)
8	6(0.15)	42(1.01)	87(2.18)
9	5(0.13)	49(1.23)	85(2.13)
10	4(0.10)	31(0.78)	82(2.05)

*Figures within brackets indicate mean scores.

(b) Tasks of Conservation of Area

(i) Index of Difficulty

Like Table 5, Table 7 was prepared. From this table it can be seen that from the stand point of index of difficulty all the 10 items meant for the measurement of conservation of area, were not suitable for 7 and 8 year children, as these items were too difficult for these age groups.

on the Tasks
a

10 years	11 years	12 years
18 (30.00)	33 (55.00)	44 (73.33)
23 (38.33)	34 (56.67)	42 (70.00)
23 (38.33)	37 (61.67)	48 (80.00)
23 (38.33)	37 (61.67)	41 (68.33)
26 (43.33)	36 (60.00)	44 (73.33)
24 (40.00)	41 (68.33)	45 (75.00)
19 (31.67)	38 (63.33)	49 (81.67)
18 (30.00)	40 (66.67)	42 (70.00)
20 (33.33)	43 (71.67)	42 (70.00)
19 (31.67)	36 (60.00)	46 (76.67)

e total scores expressed

For the other age groups (9, 10, 11, 12 years) all the items are suitable from the stand point of index of difficulty.

(ii) Discrimination Value

The same procedure was followed for finding discrimination power of each item of area conservation as in length conservation with the help of mean scores of three age subgroups. 10 sets of bar graphs were prepared (Figures 20 to 29).

From the observation of each figure in Table 8 it can be seen that the higher the age the better were the responses of the subjects given on the tasks of conservation of area. So all the 10 items showed good discrimination power.

CHOICE OF THE AGE FOR THE STUDY

It has been stated earlier that this study would be confined to only one age group. The criterion of selection of age as discussed earlier in the case of the task of spatial egocentrism was used also here.

From the view point of the index of difficulty all the conservation tasks were not suitable for 7 and 8 years old children. So the age groups were not considered. It has already been mentioned that if the difficulty level of

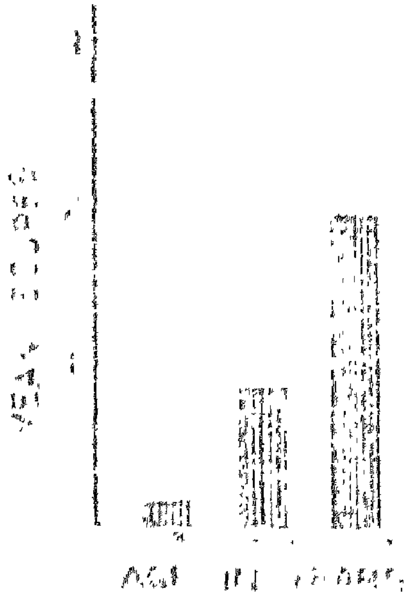


FIG.20 MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 1 (CONSERVATION OF AREA).

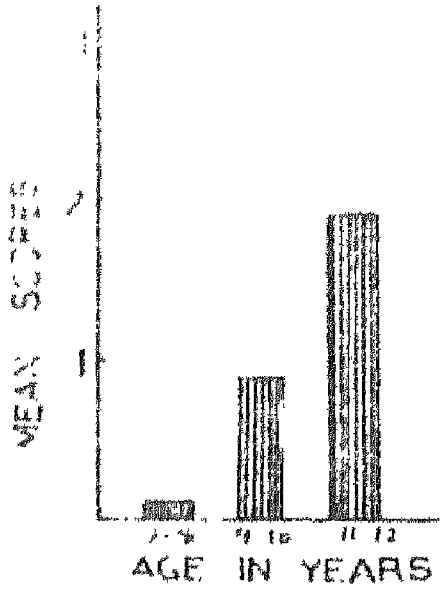
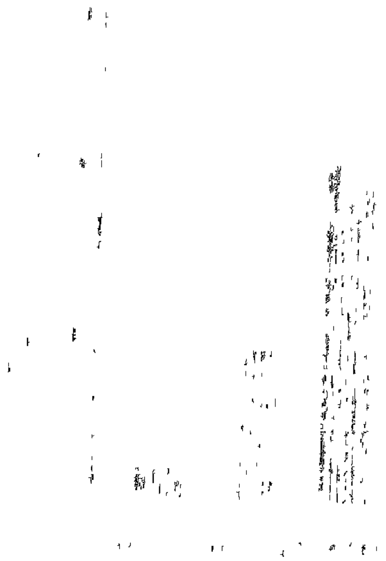


FIG.21 :MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 2 (CONSERVATION OF AREA).



[illegible] OF THREE AGE GROUPS ON
[illegible] (CONSERVATION OF AREA)

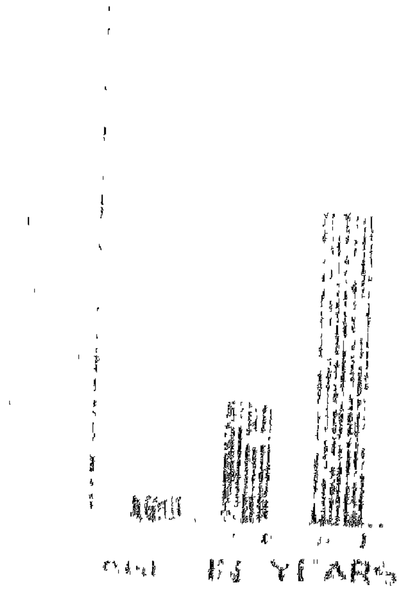
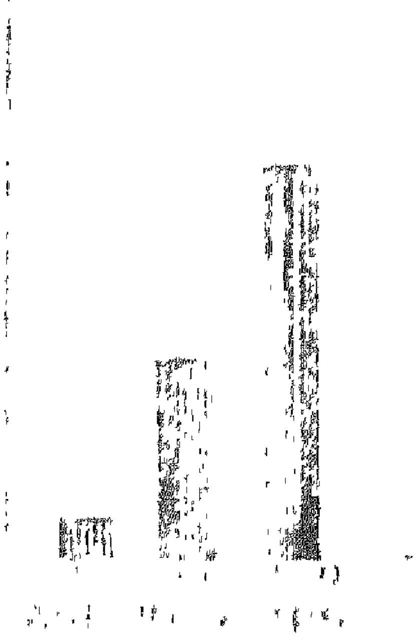
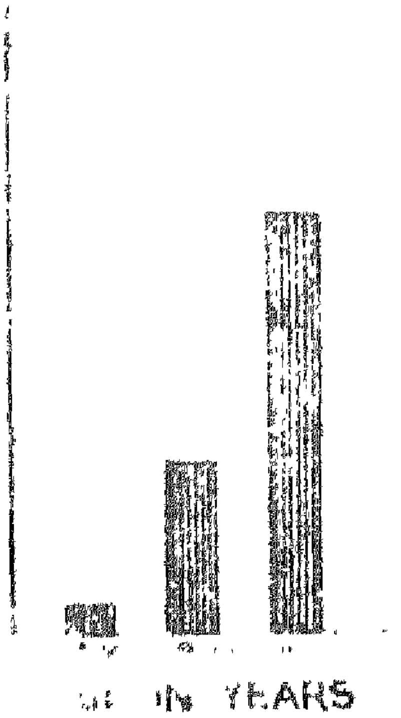


FIG. 3 MEAN SCORES OF THREE AGE GROUPS ON
ITEM NO. 4 (CONSERVATION OF AREA).



MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 5 (CONSERVATION OF AREA).



MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 6 (CONSERVATION OF AREA)

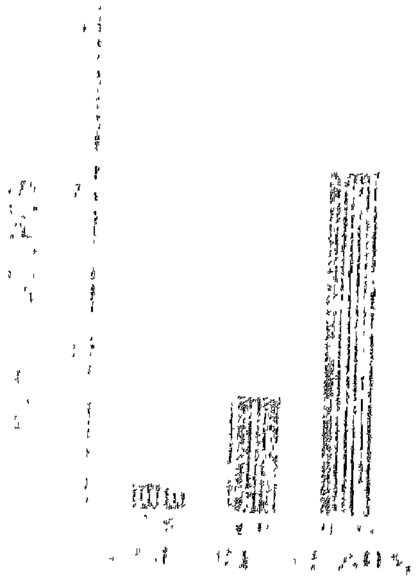


FIG 26: MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 7 (CONSERVATION OF AREA).

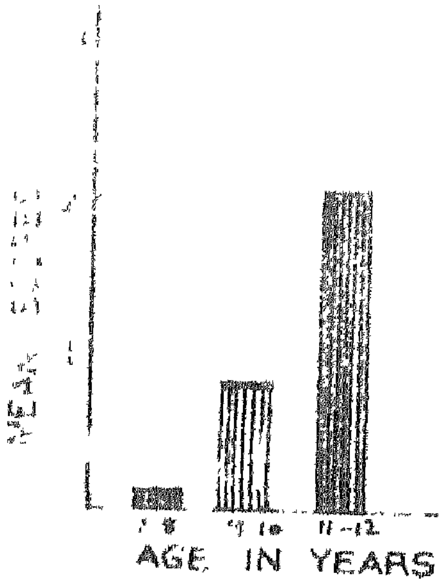
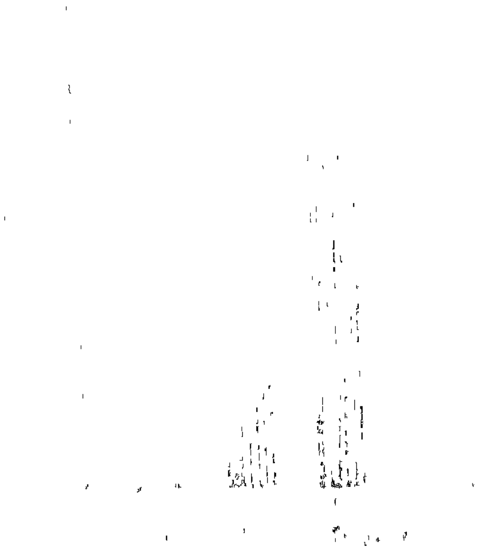


FIG 27: MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 8 (CONSERVATION OF AREA)



[illegible] THREE AGE GROUPS ON [illegible] (CONSERVATION OF [illegible])

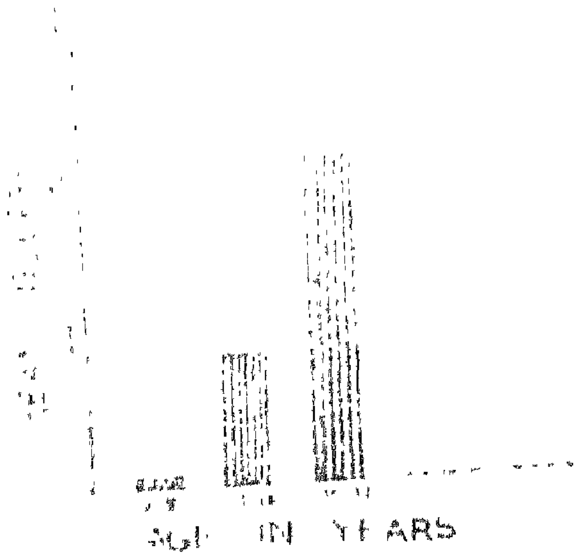


FIG 29: MEAN SCORES OF THREE AGE GROUPS ON ITEM NO 10 (CONSERVATION OF [illegible]).

TABLE - 8

Scores of Different Age Groups on the Tasks of Conservation of Area

Age	7-8	9-10	11-12
No. of Subjects	40	40	40
Item No.			
1	6(0.15)*	34(0.84)	77(1.93)
2	5(0.13)	36(0.90)	76(1.90)
3	7(0.18)	37(0.93)	85(2.13)
4	6(0.15)	31(0.78)	78(1.95)
5	8(0.20)	40(1.00)	80(2.00)
6	6(0.15)	35(0.88)	86(2.15)
7	5(0.13)	29(0.73)	87(2.18)
8	5(0.13)	32(0.80)	82(2.05)
9	1(.03)	25(0.68)	85(2.13)
10	3(0.08)	33(0.83)	80(2.00)

---

* Figures within brackets indicate mean scores.

TABLE - 9

Mean Scores on the Whole Tasks (Conservation of Length) for 3 Age Groups

Age Group	10 year	11 year	12 year
Mean score (Total)	14.49	18.00	24.3
Mean score Expressed in % of the total possible score	48.30%	60.00%	81.00%

TABLE - 10

Mean Scores on The Whole Tasks (Conservation of area) for 3 Age Groups

Age Group	10 year	11 year	12 year
Mean score(Total)	14.30	18.75	22.15
Mean score expressed in % of the total possible score	47.67%	62.5%	73.83%

a task for an age group is 50% or nearer to 50% then more discrimination within that age group is possible. From Table No.'s 9 and 10 it is noticed that for both conservation of length tasks and conservation of area tasks 10 years old group has scored about 50% of the total scores. Whereas the higher age groups have scored 60% or above. From this consideration both the tasks approved to be more suitable for 10 years group. It may be mentioned that from the same considerations task of spatial egocentrism also were found to be more suitable for 10 year old subjects. So this present study would be conducted on this age group of children only.

Reliability (Stability)

Test-retest reliability of the tasks of conservation of length and conservation of area were calculated from the scores of the same 30 subjects who have been re-tested for the task of spatial egocentrism. Reliability was only found out of eight items of each conservation of length and conservation of area which have already been selected for the final study. (Scores of test and retest are given in Appendices VIIIa and VIIIb).

Following are the spearman rank correlation coefficients (corrected for ties) between the two sets of scores on the tasks of conservation of length and conservation of area.

Rho for the tasks of conservation of length = .94

Rho for the tasks of conservation of area = .91

So both the tasks may be taken as stable.

Inter-Scorer Reliability

The response sheets of conservation of length and conservation of area of the 30 subjects of the first test have been given for scoring to the same scorer who had scored the responses of the task of spatial egocentrism (Raw scores have been given in Appendices IXa and IXb.).

Rho for conservation of length = .97

Rho for conservation of area =.94

From this account it seems that the scoring of both the task is quite objective.

CHAPTER - V

MAIN STUDY AND ANALYSIS OF THE DATA

SECTION: A

MAIN STUDY

Selection of Schools

As it has already been mentioned in the earlier Chapter that this study would be confined to only Municipal Corporation Primary Boys Schools of New Delhi South Zone. First an alphabetical list of these schools was prepared and then 50% of the schools from this list were selected randomly. In this way 37 schools out of 73 schools were selected for the final study.

At the initial stage a permission letter was obtained from the Dy. Education Officer of Municipal Corporation Primary Schools. Before collecting any information from any such school the head-masters and class teacher of these schools were contacted and their co-operation was sought.

Selection of the Subjects

In the preceeding Chapter it has been stated that only 10 year old children would be covered by this study as it was found that grade 5 had more of 10 years old children than any other grade so it was decided that 10 year old children would be taken from this grade only.

Names of the students, date of birth etc. were obtained from the school records. Then list of 10 year old children studying in grade 5 was prepared in each school and 50% of the subjects from each list were selected at random.

COLLECTION OF THE DATA

On the first day of visit to a school, only selection of the subjects was done. Time of the testing, place etc. was fixed by the head master of the school. All the testing was done during school hours.

Administration of Intelligence Test

On the second day in each school, the children were administered Raven's Coloured Progressive Matrices. Instruction were given in Hindi.

Administration of the Other Tools

On the third day tasks of spatial egocentrism was administered on the same group of children. It took 20 to 25 minutes per child to complete the task. The procedure has been discussed earlier in Chapter III.

Tasks of conservation of length and conservation of area were administered on the fourth day. These tests were

administered in two settings. Tasks of conservation of length then the tasks of conservation of area were administered following the procedure given in Chapter IV. Average time for a subject to complete both tasks required 45 to 50 minutes. In such schools where the number of selected subjects was greater than 5, two days had to be given for the administration of these two tools. Thus the administration took 4 to 5 working days in each school.

The administration was done during the period May 1977 to March 1978 i.e. during the academic session of 77 to 78. As it was decided that 300 subjects would be covered by this study, but due to absenteeism of same of the subjects only 280 subjects could be covered during this period.

Scoring of the Responses

The responses of 280 subjects on the tasks of spatial egocentrism was scored by using the procedure as suggested by Flavell et al.* The point score gives a measure which had been called "perceptual role taking skills", defined as the "S's ability to predict the appearance of the stimulus display from positions or perspectives other than his own" (Flavell et al. 1968 P.55). In this chapter the term "perceptual role-taking" will be

---

*Discussed in Chapter IV.

used in place of spatial egocentrism with the understanding that these two are inversely related.

Same scoring procedure as discussed in Chapter IV was applied in scoring the responses on the tools of conservation of length and conservation of area.

The responses on the test of Raven's Coloured Progressive Matrices was scored in the manner as given in the manual of the same test.

SECTION - B

ANALYSIS OF THE DATA

The main objectives of the study were to find the relationship between:

(i) Perceptual role - taking and conservation of length

(ii) Perceptual role taking and conservation of area

The other objectives of the study were to find the relationship between:

(A) intelligence and conservation of length;

(B) intelligence and conservation of area;

(C) intelligence and perceptual role - taking;

(D) conservation of length and conservation of area.

Measures of the four variables perceptual role - taking, intelligence, conservation of length and conserva-

tion of area were obtained. Table No. 11 shows the medians and quartile deviations of these measures.

TABLE - 11

Median and Quartile Deviation
of the Four Variables

	Perceptual Role-Taking	Conservation of Length	Conservation of Area	Intelligence
Maximum Possible Score	36	24	24	36
Median	13.67	12.50	11.60	19.23
Quartile Deviation	5.36	6.66	8.36	4.47

STUDY OF RELATIONSHIP

For studies of this kind the researchers have generally used product moment coefficient of correlation (r), partial and multiple correlation. The product moment coefficient of correlation also termed as Person's or linear correlation is one of the standard techniques used for describing or speaking in mathematical language the degree of associationship existing between two variables. Use of this type of correlation is based on the assumption that regression is linear. As Guilford has mentioned:

"The most important requirement for the legitimate use of Pearson r is that the trend of relationship between Y and X be rectilinear, in other words a straight-line-regression". (Guilford 1956, P. 149). When trend deviates from straight line, Pearson r is not justifiable as a measure of correlation. So before using this correlation linearity of regression should be checked. There are two ways of checking linearity of regression.

1. The simplest method of checking linearity is by the observation of regression lines of the scatter diagram (Garrett 1947, Dubois 1965). This method, though simple and appropriate, does not give clear indication in many cases.

2. A spacial technique of correlation which is called correlation ratio designated by the Greek letter η (eta) is also used for checking linearity of regression. Eta coefficient estimates how closely the cases cluster around a curve, rather than around a straight line. When the relation is not linear any measure of correlation which is based on the linearity of regression like product moment coefficient of correlation, fails to give the true picture of relationship.

A number of procedure have been suggested for comparing product moment coefficient of correlation and correlation ratio η (eta) for finding if the differences

between the two can be explained on the basis of chance or sampling errors (Garrett 1947 P. 372-73, Walker & Lev 1953, P. 278). If the difference cannot be explained on the basis of chance the relationship between X and Y is taken to be non-linear and product moment coefficient of correlation is not used as a measure of relationship between the two variables.

TEST OF LINEARITY OF REGRESSION

There are two methods of using Eta for testing linearity of regression:

(a) F - Test

This test is based upon analysis of variance. When N is considerably larger than K (the number of columns or number of rows in a scatter diagram) this methods can be used conveniently. (Procedure of calculation discussed in Guilford 1956, P. 294).

(b) Chi-Square Test

The second method of testing linearity of regression is in terms of chi-square (Garrett, 1947. P. 373). It tells us what is the probability of having a chi-square of the obtained magnitude, provided the relationship is linear. The formula for testing the linearity of regression

lines in terms of chi-square is:

$$\chi = (N - K)\left(\frac{\eta^2 - r^2}{1 - \eta^2}\right)$$

Where:-

N = size of sample

K = number of columns

η = eta coefficient or correlation ratio.

For testing linearity of regression, six scatter diagrams (as there were 4 variables, 4C2 = 6 pairs could be made) were constructed for different pairs of variables as indicated below:

1. perceptual-role taking and conservation of length
2. perceptual-role taking and conservation of area
3. perceptual-role taking and intelligence
4. intelligence and conservation of length
5. Intelligence and conservation of area
6. conservation of length and conservation of area

These scatter diagrams have been shown in Tables 12a 12b, 12c, 12d, 12e and 12f.

Calculation of Eta Coefficient and r

From the scatter diagram it was not possible to predict with any certainty whether the trend was linear or non linear. So eta coefficient and r were calculated for

TABLE 1[illegible]

Scatter Diagram: indicating relationship between perceptual-role taking and conservation of length

Percep.-role taking Conserv. of Length	0–2	3–5	6–8	9–11	12–14	15–17	18–20	21–23	24–26	27–29	30–32	33–35	36–38	Total
24–25			1						3	4	4	3	2	17
22–23					1		2	1	3	3	2		1	13
20–21				1			7	2	3	1				14
18–19				1		1	8	3	1	2				16
16–17			3	6	3	13	13	7	1					46
14–15					1	6	5	2						14
12–13	1			2	7	8	2							20
10–11				1	6	4	1							12
8–9		2	4	9	6	2	1							24
6–7		2	3	2	3	2								12
4–5	1	1	9	4	5	1	4							25
2–3	1	1	7	6	2			1		1				19
0–1	3	10	23	10	2									48
Total	6	16	50	42	36	37	43	17	11	11	6	3	3	280

TABLE 12b

Scatter Diagram: Indicating relationship between perceptual-role taking and conservation of area

Percep. role taking → Conserv. of Area ↓	0–2	3–5	6–8	9–11	12–14	15–17	18–20	21–23	24–26	27–29	30–32	33–35	36–
24–25					1			2	4	2	4	3	2
22–23			1				3	4	1	2	1		1
20–21							7	1	6	4	1		
18–19				2		2	5	2		1			
16–17			2	4	1	11	17	3					
14–15			1	1	4	7	5	2					
12–13			1	1	5	2	1	1		1			
10–11			2	3	6	6	1						
8–9	1	1	3	3	4	6	1	1					
6–7			2	2	3	1							
4–5		1	4	3	4								
2–3	2	1	3	5	2	1	1						
0–1	3	13	31	18	6	1	2	1		1			
Total	6	16	50	42	36	37	43	16	11	11	6	3	3

TABLE 12c

Scatter Diagram: Indicating relationship between Intelligence and Conservation of Length

Intelligen. → Conserv. of Length ↓	2-4	5-6	8-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	Total
24-25						2	4	1	2	4	3	1	17
22-23				1	1	1	5		1	4			13
20-21					3		5	4	1	1			14
18-19				2	3	2	1	5	2			1	16
16-17			2	5	5	5	9	10	8	1	1		46
14-15				2	4		3	2	1	2			14
12-13				1	5	3	4	5	2		1		20
10-11					4	1	3	3	1	1			12
8-9	1		2		8	8		1	2	2			24
6-7	1		1		3	2	2	2	1				12
4-5	3		2	3	4	5	2	5	2				25
2-3		1	2	5	6		2			1			19
0-1	1		5	7	7	16	9	3					48
Total	6	1	14	26	53	44	49	41	23	16	5	2	280

TABLE 12d

Scatter Diagram: Indicating relationship between Intelligence and Conservation of Area

Intelligence → Conservation of Area ↓	2-4	5-7	8-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	Total
24-25							5	3	1	4	4	1	18
22-23					1	2	1	2	3	3			12
20-21					4	3	4	4	3	1			19
18-19			1	1	1		2	3	3	1			12
16-17			1	4	5	2	8	8	7	1	1	1	38
14-15			1	2	4	1	1	6	1	3	1		20
12-13				2	2	2	4	1	1				12
10-11			1	1	4	4	5	3					18
8-9	1		1	1	4	5	3	4	1				20
6-7	1		1	1	1	2	1	1					8
4-5			2	1	2	3	1	1	1	1			12
2-3	1	1			3	4	3	2		1			15
0-1	3		6	13	22	16	1	3	2	1			76
Total	6	1	14	26	53	44	49	41	23	16	6	2	280

TABLE 12e

Scatter Diagram: Indicating relationship between
Intelligence and percept-role taking

Intelligence → Percept, role taking ↓	2-4	5-7	8-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	Total
36 & above							2					1	3
33-35				1						1	1		3
30-32							1		1	1	2		5
27-29					2	1	1	1	2	4			11
24-26					2	1	4	2	1	1			11
21-23			1	2		1	6	3	3	1			17
18-20	2		1		10	3	7	9	6	3	1	1	43
15-17	1			5	7	4	6	11	3				37
12-14			3	3	9	5	3	7	3	3			36
9-11		1	3	4	7	12	9	3		2	1		42
6-8	2		4	6	11	13	7	4	3				50
3-5			1	5	4	4	1		1				16
0-2	1		1		1		2	1					6
Total	6	1	14	26	53	44	49	41	23	16	5	2	280

TABLE 12f

Scatter Diagram: Indicating relationship between Conservation of Length and Conservation of Area

Conserv. of Length → Conserv. of Area ↓	0–1	2–3	4–5	6–7	8–9	10–11	12–13	14–15	16–17	18–19	20–21	22–23	24–25	Total
24–25									1		1	2	13	18
22–23									2		3	4	3	12
20–21								1	2	7	5	4		19
18–19							1		3	5	1	2		12
16–17			3			2	3	3	19	4	4			38
14–15			1			3	4	5	6			1		20
12–13					2	2	1	2	4				1	12
10–11					5	1	6	3	3					18
8–9	4		2	1	5	1	4		3					20
6–7	1	1	3		3									8
4–5	3	1	3	2			1		2					12
2–3	2	3	3	3	3				1					15
0–1	37	14	10	6	6	3								76
Total	48	19	25	12	24	12	20	14	46	16	14	13	17	280

each of the scatter diagram by applying the following formula:

$$\eta_{yx} = \frac{\sqrt{\frac{\sum\left[\frac{(\sum y')^2}{f_x}\right]}{N} - c_y'^2}}{\sigma_y}$$ (Garrett, 1947, P.370)

$$\eta_{xy} = \frac{\sqrt{\frac{\sum\left[\frac{(\sum x')^2}{f_y}\right]}{N} - c_x'^2}}{\sigma_x}$$

Eta Coefficient and r were calculated from the same scatter diagrams. One of the weakness of eta coefficient is that its size depends upon the number of classes (Guilford 1956). In the case of too small number of classes there are chances of obtaining too small correlation. To avoid this statisticians (Guilford, 1956; McNemar 1962) have suggested that at least twelve intervals should be used. This is possible only when sample size is large, say, 100 or above. The sample in this study is 280 and so this question could be taken care of.

After calculating eta coefficient and product moment correlation linearity of regression was checked by the formula:

$$\chi^2 = (N - K)\left(\frac{\eta^2 - r^2}{1-\eta^2}\right)$$ (Garrett 1947, P.373)

Where N = Size of sample

K = Number of Columns.

η = Eta coefficient or correlation ratio

The results have been shown in Table 13.

TABLE – 13

r's, Eta Coefficients etc. of Different Pairs of Variables

Variables →	Percep. role-taking and Conserv. of length	Percep. role taking and Conserv. of Area	Percep. role taking and Intelligence	Intelligence and Conserv. of length	Intelligence and Conserv. of Area	Conserv. of length and Conserv. of Area
r	.79	.78	.40	.43	.47	.87
eta xy	.82	.80	.43	.47	.51	.87
Chi-square Xy	40.45	20.54	5.32	13.74	14.49	0.00
Significance at .05 level	Significant	Significant	not significant	not significant	not significant	not significant
eta Yx	.80	.79	.45	.47	.50	.88
Chi-square Yx	7.03	7.03	16.90	13.74	10.68	23.22
Significant at .05 level	not significant	not significant	significant	not significant	not significant	significant
Conclusions:	One regression is linear and the other not linear, r can not be used	One regression is not linear and other is linear, r can not be used	One regression is linear and other is not linear, r can not be used	Both regressions are linear, r can be used	Both regression are linear, r can be used	One regression is linear and the other is not linear, r cannot be used

It may be observed from Table 13 that only in two scatter diagrams both the regression lines are linear while in the rest of the scatter diagrams one regression line is linear and other is not linear. This result agrees with Ayer's et al. (1974) who found that relationship between Piagetian tasks and psychometric Variables are nonlinear. As relationship between variables were not linear (in 4 out of 6 cases) the product moment coefficient of correlation was not used as measure of relationship.

CHI-SQUARE TEST AND CONTINGENCY COEFFICIENT

One of the common techniques for finding out if there is any relationship between two variables (for testing the null hypothesis of no relationship or testing independence) when relationship is nonlinear is Chi-Square test. This test is not based on any restrictive assumptions concerning the form of population from which the cases have been drawn or the nature of distribution of X and y or about the characteristic of the regression lines.

The researcher starts with the null hypothesis that the variables are not related, that they are independent of each other and whatever relationship has been observed can be explained on the basis of chance. The larger the obtained value of χ^2 the lower is the probability of obtaining such a value on the basis of chance factor.

A significant value of chi-square tells that a real relationship exists but the degree of relationship is not indicated by chi-square test.

Finding the degree of relationship in numerical term (as in r) requires another step-calculation of contingency coefficient (C). There is no restriction in using contingency coefficient as the measure of degree of relationship. The variable can be discrete or continuous, ordered or unordered and the distribution of population can be of any form. The only requirement for the use of this technique is that the variables can be "classified into mutually exclusive categories". (Lindquist ,1940, P. 30). Chi-square may be used for the calculation of contingency coefficient (C) which gives a numerical value of the relationship between two variables. This is roughly comparable with r. (contingency coefficient can also be directly calculated avoiding the calculation of chi-square as a first step. Yule & Kendall 1958 P. 55). It was decided that chi-square would be used for the calculation of contingency coefficient.

According to Freund "Contingency coefficients are in many respects similar to ordinary correlation coefficient being close to zero where there is no correlation and close to one when the relationship is strong". (Freund 1960 P. 350). But the exact meaning of the contingency coeffi-

cient is not fixed because its upper limit depends on the number of cells used in calculation of coefficient ratio. In a square table with t rows and t columns the upper limit of the contingency coefficient is given by the formula $\sqrt{t-1/t}$. For example in the case of 5 x 5 contingency table C cannot exceed $\sqrt{5-1/5}$ =.894. While for 4 x 4 contingency table the maximum possible value of C is .866. (Yule & Kendall 1958, P. 54). When number of cells increases the upper limit of C increases but never reaches 1.00.

Categorization of Data and Preparation of Contingency Tables

As linear correlation was not suitable in this study, Chi-square and contingency coefficient were calculated. For this purpose six contingency tables ($4C2 = \frac{4 \times 3}{1 \times 2} = 6$) were prepared.

Chi-square is based on the assumption that the data may be such that it can be classified into "mutually exclusive categories" (Lindquist 1940 P. 30). While preparing contingency table 2 points should be kept in mind:

1. In the contingency table the number of cells should be sufficiently large because the upper limit of contingency coefficient depends on the numbers of cells as has already been stated. The upper limits of C increases with the

increase of the number of cells.

2. The second point is that expected frequency in any cell should not be too small[*]. Different statisticians have suggested different minimum permissible size of expected frequency. Lindquest would like to have it greater than 10 (Lindquist 1940, P. 34). According to Walker & Lev "The Chi-square curve provides an adequate approximation when the least expected frequency in any cell is five. This requirement seems excessively high." (Walkar & Lev, 1953, P. 107). They have further stated that "If there are more than 2 degrees of freedom and expectation in all cells but one is 5 or more, then an expectation of only one in the remaining cell is sufficient to provide a fair approximation to the exact probabilities." (Walker & Lev 1953, P. 107). Guilford (1956, P. 239) as well as McNemar[**] (1962, P. 218) have suggested that the expected frequency in each cell should not be less than 2.

However it was though that while constructing contingency table, it would be safer to keep the minimum permissible size of fe in cell as 5. In no case fe in any cell should be less than 2.

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[*] According to Dubuir "there is no restriction on the size of fo which may be zero." (Dubois, 1965, P. 67)

[**] "When df is not small, expected frequency as low as 2 will not produce misleading chi-square values"(McNemar, 1962, P. 218).

Keeping the above two points in mind 5 x 5 contingency tables were prepared.

To prepare 5 x 5 contingency table the whole group was subdivided into 5 subgroups roughly equal in size on each variable. The score of all the 280 cases were arranged in descending order. Roughly 1/5 from the top formed the top group. The second 1/5 from the top formed the second group from the top - The middle 1/5 formed the middle group . The bottom 1/5 formed the bottom group while the the next 1/5 form the bottom group formed the 2nd group from the bottom.

Because of the nature of actual distribution subgroups of exactly equal size were not possible. For example, in the case of conservation of area, 75 subjects out of 280 have scored zero. 1/5 of 280 cases is 56. There is no scope of keeping 56 of the 75 subjects in the bottom sub group and rest in the next subgroup. It would have vitiated the important requirement of "mutually exclusive categories". So all the 75 had to be kept in the bottom group. For the same or similar reason there is no variable in which subgroups could be of exactly the same size.

The contingency tables have been shown in the following pages. For different contingency tables fe for each

cell was calculated by the formula:

$$fe = \frac{(\Sigma\ fr)\ (\Sigma\ fk)}{N}$$

When:-

fr = sum of any row

fk = sum of any column

N = size of the sample

Expected frequency for different cells of the contingency tables have been shown in Tables 14 to 19. It can be seen from these contingency tables that expected frequency in no cell was less than 5. It was taken that the use of these tables for calculation of chi-square and contingency coefficient would be quite appropriate.

Calculation of Chi-square and Contingency Coefficient

Chi-square for each of the table was calculated using the following formula:

$$C = \sqrt{\frac{\chi^2}{N = \chi^2}}$$

Chi-square and contingency coefficients for the six pairs of variables have been shown in Table 20.

TABLE - 14

Contingency Table Indicating Association Between Perceptual Role Taking & Conservation of Length

Per. R.T. → Con. of Length ↓	0-7	8-11	12-16	17-20	21 & above	Total
19 & above	1 (9.45)*	4 (12.92)	1 (11.19)	12 (10.61)	36 (9.84)	54
16-18	1 (8.75)	8 (11.96)	6 (10.36)	24 (9.82)	11 (9.11)	50
9-15	2 (9.80)	8 (13.40)	32 (11.60)	12 (11.00)	2 (10.20)	56
3-8	16 (10.50)	20 (14.36)	16 (12.43)	7 (11.79)	1 (10.93)	60
0-2	29 (10.50)	27 (14.36)	3 (12.43)	- (11.79)	1 (10.93)	60
Total	49	67	58	55	51	280

χ^2 = 263.32 C = .70

*Figures within the bracket indicate fe for that cell.

TABLE - 15

Contingency table indicating association between Perceptual Role Taking & Conservation of Area.

Per. R.T. → Cons of Area ↓	0-7	8-11	12-16	17-20	21 & above	Total
19 & above	1 (8.75)*	1 (11.96)	1 (10.36)	10 (9.82)	37 (9.11)	50
16-18	1 (8.75)	7 (11.96)	7 (10.36)	28 (9.82)	7 (9.11)	50
9-15	1 (8.58)	8 (11.73)	27 (10.15)	9 (9.63)	4 (8.93)	49
1-8	11 (9.80)	23 (13.40)	16 (11.60)	5 (11.00)	1 (10.2)	56
0-7	35 (13.13)	28 (17.94)	7 (15.54)	3 (14.73)	2 (13.66)	75
Total	49	67	58	55	51	280

χ^2 = 279.84 C = .71

*Figures within the bracket indicate fe for that cell.

TABLE - 16

Contingency Table Indicating the Association Between Intelligence and Conservation of Length

Intelligence → Con. of Length ↓	2-14	15-17	18-20	21-24	25 & above	Total
19 & above	3 (11.76)*	8 (10.22)	9 (10.99)	11 (10.03)	23 (10.99)	54
16-18	8 (10.89)	6 (9.46)	9 (10.18)	16 (9.29)	11 (10.18)	50
9-15	3 (12.20)	15 (10.60)	8 (11.40)	10 (10.40)	15 (11.40)	56
3-8	20 (13.07)	13 (11.36)	13 (12.21)	8 (11.14)	6 (12.21)	60
0-2	22 (13.07)	11 (11.36)	18 (12.21)	7 (11.14)	2 (12.21)	60
Total	61	53	57	52	57	280

$\chi^2 = 66.05$ $C = .44$

*Figures within the bracket indicate fe for that cell.

TABLE - 17

Contingency Table indicating Association Between Intelligence and Conser. of Area

Intelligence → Con. of Area ↓	2-14	15-17	18-20	21-24	25 & above	Total
19 & above	1 (10.89)*	7 (9.46)	6 (10.18)	13 (9.29)	23 (10.18)	50
16-18	7 (10.89)	7 (9.46)	10 (10.18)	10 (9.29)	16 (10.18)	50
9-15	8 (10.68)	10 (9.28)	10 (9.98)	12 (9.10)	9 (9.98)	49
1-8	14 (12.20)	13 (10.60)	12 (11.40)	12 (10.40)	5 (11.40)	56
0	31 (16.34)	16 (14.20)	19 (15.27)	5 (13.92)	4 (15.27)	75
Total	61	53	57	52	57	280

$\chi^2 = 75.19$ C = .46

*Figure within the bracket indicate fe for that cell.

TABLE - 18

Contingency Table Indicating the Association Between Intelligence & Perceptual-Role Taking Skill

Intelli-gence → Perc. R.T. ↓	2-14	15-17	18-20	21-24	25 & above	Total
21 & above	4 (11.11)*	5 (9.65)	9 (10.38)	12 (9.47)	21 (9.47)	51
17-20	9 (11.98)	11 (10.41)	10 (11.20)	12 (10.21)	13 (10.21)	55
12-16	15 (12.64)	14 (10.98)	5 (11.81)	11 (10.77)	13 (10.77)	58
8-11	14 (14.60)	16 (12.68)	20 (13.64)	10 (12.44)	7 (10.44)	67
0-7	19 (10.68)	7 (9.28)	13 (9.98)	7 (9.1)	3 (9.1)	49
Total	61	53	57	52	57	280

$\chi^2 = 58.42$ $C = .52$

*Figures within the bracket indicate fe for that cell

TABLE - 19

Contingency table indicating Association between Conservation of Length and Conservation of Area

Cons of Length → Cons of Area ↓	0-2	3-8	9-15	16-18	19 & above	Total
19 & above	1 (10.71)*	- (10.71)	3 (10.00)	5 (8.93)	41 (9.64)	50
16-18	- (10.71)	3 (10.71)	9 (10.00)	27 (8.93)	11 (9.64)	50
9-15	- (10.5)	4 (10.50)	31 (9.80)	12 (8.75)	2 (9.45)	49
1-8	13 (11.20)	28 (11.20)	10 (11.20)	5 (10.00)	- (10.8)	56
0	46 (16.07)	25 (16.07)	3 (15.00)	1 (13.39)	- (14.46)	75
Total	60	60	56	50	54	280

$\chi^2 = 380.27$ C = .76

*Figures within the bracket indicate fe for that cell

TABLE - 20

Chi-Square and Contingency Coefficient for all Pairs of Variables

Variables	2	Sig. at .01 Level	C	Null Hypothesis
Intelligence and Length Cons.	68.05	Sig.	.44	Null Hypothesis is rejected
Intelligence and Area Cons.	75.19	"	.46	"
Intelligence and Percp. Role Taking	58.42	"	.52	"
Per. Role Taking and Length Cons.	263.32	"	.70	"
Per. Role Taking and Area Cons.	279.84	"	.71	"
Length Cons. and Area Cons.	380.27	"	.76	"

Significance of the Obtained Value of C

Value of C may be easily evaluated on the basis of Chi-square and if Chi-square is significance C may be taken as significant. In all the tables the df is 16. For df = 16, the minimum value of Chi-quare significant at .05 and .01 levels are 24.996 and 30.578 respectively (Lindquist 1940, Table 2. P. 36). All the values of Chi-square were larger than 30.578, the minimum value needed for significance at .01. So all the values of Chi-square were taken as highly significance at .01. (The null hypothesis of independence or no relationship was rejected). Consequently all the contingency coefficients were also taken as significant at .01 level.

As can be found from Yule & Kendal (1958, P. 54) the maximum possible value of C in 5 x 5 contingency table (when the two variables are in perfect agreement) is .894. The obtained C's between perceptual role taking and conservation of length and perceptual role taking and conservation of area are .70 and .71 respectively. These coefficients may be taken as high and hence pairs of variables are highly correlated. Mathematically the value of contingency coefficient may be either positive or negative. Contingency coefficient only indicates degree of relationship and not the direction of relationship. Whether the relationship is positive or negative can be

found by a careful observation of the scatter diagrams. A careful observation of contingency tables (No. 14 to 19) would indicate that all the contingency coefficients are positive. Also while testing linearily of regression, product moment correlations were calculated and all the r's were found to be positive. Hence all the C's were to be taken as positive.

It has already been mentioned that perceptual role - taking may be considered as inversely related with spatial egocentrism. As perceptual role-taking is positively and highly related with conservation of length and conservation of area, the relationship between egocentrism and conservation of length and spatial egocentrism and conservation of area may be taken as high negative correlations.

It will be worthwhile to compare the findings of Rubin's study (1973a) with that of the present study. Rubin used the same tool for the measurement of spatial egocentrism as used in this study. But his tool for the measurement of conservation was different. Instead of using different aspects of conservation separately in separate tools as was done in this study (separate scales were used to measure the conservation of length and conservation of area) Rubin used five of the six conservation problems of Goldschmid & Bentler's (1968) Concept Assessment Kit - Form A. These five problems were directed to measure conservation of two

dimensional sapce, number, substaince, weight and continuous quantity. He did not consider either conservation of length and conservation of area. Rubin has calculated r but has not mentioned whether he has tested linearity of regression (In the present study some of regression lines were found to be nonlinear for different pairs of variables and C's were calculated). Rubin found a moderate relation between perceptual role - taking as measure by the tool of Flavell et al. (1968 Task IC) and conservation measured be Goldschmid & Bentter's Concept Assessment Kit-Form A (r = .65). The present study has indicated a high correlation (C = .70 and .71, in 5 x 5 contingency tables). In both the studies significant positive correlations were found. As mentioned earlier, the actual relationship between spatial egocentrism and conservation of length or spatial egocentrism and conservation of area may be taken as negative.

A number of studies have been conducted in order to find out the relationship between intelligence as measured by psychometric tools and Piagetian tests (Dodwell 1960), 1962, Beard 1960, Almy et al. 1966, 1970. Kohelberg & DeVries 1974, & Elkind 1961). Some of them have reported low relationship (Dodwell 1960, 1962, Beard 1960) and other have reported moderate relationship (Almy et al. 1966, 1970).

The relationship between intelligence as measured by Raven's coloured Progressive Matrices and conservation was studied by Bat-Hass et al. (1972), Carlson & Wield (1976) and Rao (1976). These researchers found that intelligence was positively and significantly correlated with conservation. One of the researchers (Rao, 1976) has mentioned about conservation of length and area. But he has not use separate tools for measurement of these characteristics. He has not found the relationship between intelligence and these variables separately. Other researchers have found out the relationship between intelligence and conservation of quantity and intelligence and conservation of substance etc.

In the present study contingency coefficient (C) between perceptual role taking and conservation of length is .70 and C between intelligence and conservation of length is .44. The former value is much larger than the later. In the same manner C between perceptual role-taking and conservation of area (.71) is much higher than the C between intelligence and conservation of area (.46). The researcher found no suitable procedure for testing the significance of difference between two C's. However a large difference in obtained C suggest conservation of length and conservation are more closely related with perceptual role - taking than with intelligence.

Goldschmid and Bentler (1968) while standardizing and scaling Piagetian tasks found that conservation of length, area, distance and three dimentional space form a homogeneous cluster and that a separate cluster formed by the conservation of number, weight, substance etc. So they put conservation of length, area, distance and three dimensional space in a common scale entitled as 'Form C'. As these variables form a cluster it can be taken that conservation of length and conservation of area are significantly related.

CONTROL OF INTELLIGENCE

As intelligence is significantly correlated with conservation of length, conservation of area and perceptual role taking, even if there was no real relationship between perceptual role taking and conservation of length and perceptual role taking and conservation of area, because of intelligence these two pairs of variable would have shown some correlation. It can be safely stated that in such a situation the obtained C between perceptual role taking and conservation of length would not have been more than .44 (C between intelligence and conservation of length) or .52 (C between intelligence and perceptual role taking) But the obtained value of C between perceptual role taking and conservation of length was much greater (.70) than the two coefficients (.44, and .52). In the same way the

obtained value of C between perceptual role-taking and conservation of area is also much higher than the obtained C (.46) between intelligence and conservation of area and C (.62) between intelligence and perceptual role-taking. It is not possible to explain these coefficients on the basis of a third factor i.e. intelligence. The contribution of intelligence would be slightly towards these obtained C but this cannot explain such high values of C obtained in this study. In the same way it can be argued that the obtained correlation between conservation of length and conservation of area could not be explained on the basis of third factor (intelligence) only.

If the relationship were linear partial correlation could have been very conveniently used to find out what would have been the correlation between (I) perceptual role taking and conservation of length, (II) perceptual role-taking and conservation of area, but this method could not be used (reasons are given earlier in this Chapter). If it were possible to have a group of subjects of exactly the same level of intelligence and the study was repeated, the answer could have been obtained.

The only alternative available for getting answer to this question was to select a group of subjects within a small range of intelligence and to calculate the contingency coefficients for that restricted group. For this purpose

subjects whose intelligence score were within the range Mdn ± Q were taken. Mdn - Q was 15.76 (16 approximately) and Mdn + Q was 23.70 (24 approximately). The intelligence score of 139 subjects fell within the range of 16 to 24. Three 5 x 5 contingency tables were prepared to calculate the C's between (i) Perceptual role-taking and conservation of length, (ii) Perceptual role-taking and conservation of area, (iii) Conservation of length and conservation of area.

The same procedure was followed in the categorization of data, preparation of contingency tables and calculation of C's as in the case of whole sample (280 cases). When 5 x 5 contingency tables were prepared with 139 cases it was found that in no cell the expected frequency was less than 3. Thus fulfilling the requirement of Guilford (1956, P. 239) and McNemar (1962, P. 218) according to whome if the expected frequency is not less than 2, it will not affect the values of Chi-square and contingency coefficients. The fo and fe for three pairs of variables (when intelligence is controlled) were shown in Tables Nos. 21, 22, and 23. It may be mentioned here that further restriction of range say taking a range of Mdn ± ½Q would have reduced the number of cases and 5 x 5 contingency tables would have shown very low expected frequencies in some of the cells. So further restriction of intelligence was not attempted.

TABLE - 21

Contingency table indicating association between perceptual role-taking and conservation of length

Per. R.T. → Cons. of Length ↓	0-7	8-10	11-14	15-19	20 & above	Total
18 & above	1 (4.47)*	4 (5.63)	- (5.24)	2 (6.02)	20 (5.63)	27
16-17	- (4.47)	4 (5.63)	4 (5.24)	12 (6.02)	7 (5.63)	27
9-15	1 (4.47)	3 (5.63)	10 (5.24)	11 (6.02)	2 (5.63)	27
3-8	9 (4.80)	5 (6.05)	9 (5.63)	6 (6.47)	- (6.05)	29
0-2	12 (4.80)	13 (6.05)	4 (5.63)	- (6.47)	- (6.05)	29
Total	23	29	27	31	29	139

$\chi^2 = 118.77$ $\quad$ $C = .68$

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*Figures within the brackets indicate fe for the cell

TABLE - 22

Contingency table Indicating Association Between perceptual role taking and Conservation of Area

Prcep. → R.T. Area (cons.) ↓	0-2	3-8	9-15	16-17	18 & above	Total
20 & above	1 (3.97)*	1 (5.01)	1 (4.66)	2 (5.35)	19 (5.01	24
15-19	1 (3.81)	3 (4.80)	2 (6.41)	11 (5.13)	6 (4.80)	23
9-14	- (4.80)	7 (6.05)	9 (5.63)	10 (6.47)	3 (6.05)	29
1-8	10 (5.46)	6 (6.88)	10 (6.41)	6 (7.36)	1 (6.88)	33
0	11 (4.96)	12 (6.26)	5 (5.83)	2 (6.70)	- (6.26)	30

χ^2 = 100.99   C = .65

*Figures within the bracket indicate fe for the cell

TABLE - 23

Contingency table Indicating Association Between Conservation of Length and Conservation of Area

Con. of Length → / Con. of Area ↓	0-2	3-8	9-15	16-17	18 and above	Total
20 & Above	1 (6.05)*	1 (6.05)	- (4.66)	2 (4.66)	20 (4.66)	24
15-19	- (4.80)	1 (4.80)	4 (6.41)	12 (6.41)	6 (6.41)	23
9-14	- (6.05)	2 (6.05)	18 (5.63)	8 (5.63)	1 (5.63)	29
1-8	9 (6.88)	16 (6.88)	4 (6.41)	4 (6.41)	- (6.41)	33
0	19 (6.26)	4 (6.26)	1 (5.83)	1 (5.83)	- (5.83)	30
Total	29	29	27	27	27	139

$\chi^2 = 181.50$ $C = .75$

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*Figures within the brackets indicate fe for that cell.

Contingency coefficients with intelligence not controlled and intelligence controlled have been shown below in Table 24. From this table it is evident that contingency coefficients were slightly reduced when intelligence was controlled. Even then the obtained C's between perceptual-role taking and conservation of length (.68), perceptual-role taking and conservation of area (.65) and conservation of length and conservation of area (.75) were high. When these C's are compared with the maximum possible value (.89) for a 5 x 5 table, these can be taken as highly correlated. The coefficients are also positive this point has been discussed earlier in this Chapter.

TABLE - 24

Chi-square, Contingency Co-efficient for 3 pairs of variables

Statistics	Intelligence Not Controlled			Intelligence Controlled		
Variable	Chi-Square	C	Sig.	Chi-square	C	Sig.
Percept. Role-Taking & Cons. of length	263.32	.70	Sig. at .01	118.77	.68	Sig. at .01
Percept. Role-Taking & Cons. of Area	279.84	.71	Sig. at .01	100.99	.65	Sig. at .01
Conservation of Length & Area	380.27	.76	Sig. at .01	181.50	.75	Sig. at .01

CHAPTER - VI

SUMMARY, CONCLUSIONS & SUGGESTIONS

SUMMARY

The study was started with two main objectives:

(A) To find whether spatial egocentrism is related to conservation of length.

(B) To find whether spatial egocentrism is related to conservation of area.

The other objectives of the study were:

(i) To examine the relationship between intelligence and spatial egocentrism.

(ii) To find whether intelligence is related to conservation of length.

(iii) To find the relation of intelligence with conservation of area

(iv) To examine whether conservation of length and conservation of area are interrelated.

Four tools were needed for this study.

I. A tool for assessment of spatial egocentrism: No study has been conducted in India in this field and so no Indian tool is available for this purpose. Only one suitable tool developed by Flavell et al. (1968 Task IC) could be identified. Flavell et al. have considered the tool as a tool indicating perceptual role taking skills. The same tool has been used by Rubin (1973) for the purpose of

assessment of spatial egocentrism. It appears that his use was justified. To take role of another person, one should come out of his egocentric shell. One whose egocentrism is high, cannot do well in perceiving some other persons' role. So it was considered that Flavell's et al.'s task could give a measure of egocentrism. It was taken that a high score on this tool meant a low score in spatial egocentrism and a low score meant a high score in egocentrism. This tool was used in the present study after translating the directions and instructions in Hindi and after try out of the tasks.

II. A test for assessment of intelligence of the children. Raven's coloured progressive Matrices was used for this purpose.

III & IV: The third and Fourth tools required by for this study were for assessment of conservation of length and for assessment of conservation of area. The researcher could not find any tool either for the assessment of conservation of length or for assessment of conservation of area. Indeed in India a number of studies have been conducted in the field of conservation and a few tools have been used on ad hoc basis, assembling a number of tasks used by Piaget and others. But no tool has been developed for assessing conservation in a particular area such as number,

length, area, quantity, volume, weight etc. The Indian researchers have generally taken items from different areas of conservation and used them in a general test of conservation. Another drawback of these tools is that all the tools are ad hoc tools. They have not been developed after any kind of tryout and analysis of the item. Considering these points it was decided that for assessment of conservation of length and conservation of area two tools would be developed by the researcher. 10 tasks were assembled to assess conservation of length and 10 tasks to assess conservation of area. These tasks were taken from Piaget et al's (1960) experiments. Some of the original tasks were modified to suit Indian conditions. Instruction in Hindi were prepared.

All the items of conservation were checked by two persons who were familiar with the developmental Psychology of Piaget and test construction. They also had sound knowledge of Hindi.

Pre-tryout of the tasks of spatial egocentrism, conservation of length and area was done on 10 children - 5 aged 9 years and 5 aged 10 years. After pre-tryout some modifications had to be made in instructions and also few items of conservation tasks had to be modified.

Tryout of the three tools was done on 120 children ranging in age from 7 to 12 years. 7, 8, 9, 10, 11 and 12 year* old children were selected from Grades 2, 3, 4, 5, 6 and 7 respectively.

It was found that in grade 2 there were proportionately larger number of 7 year old children as compared to other grades and so for the sake of convenience, 7 year old children were selected only from grade 2 of Municipal Corporation Primary Boy Schools. In the same way 8, 9 and 10 year old children were selected respectively from 3, 4 and 5 grade of the Municipal Corporations Primary Boys Schools. All these schools were located in New Delhi South Zone. As primary schools do not have 6 and 7 grades, 11 and 12 years old subjects were taken respectively from grades 6 and 7 of Higher Secondary Schools located in the same area (New Delhi South Zone). Random sampling technique was applied in the selection of schools and subjects. 5 Municipal Corporation Primary Boys' Schools and 3 Higher Secondary Schools from amongst the 11 Municipal Corporation Primary Boys Schools and 7 Higher Secondary Boys Schools

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* Subjects of 7 years mean those subjects who have completed 7 years but not completed 8 years, in the same way 8 years subjects mean those subjects who have completed 8 years but have not completed 9 years.

respectively were selected. These schools were within walking distance from the NIE Campus. From each Municipal Corporation Boys School 4 children for each age group (7 to 10 years olds) were selected. 6 or 7 children were selected at random from each Higher Secondary School for age groups 11 and 12 years. All the three tools were administered on the same group of subjects. Administration was done individually. On the first day, tasks of spatial egocentrism, and on the second day tasks of conservation of length and area were administered. The whole tryout was completed within 2 months.

Scoring of the responses of the tasks of spatial egocentrism was done as suggested by Flavell et al. To score the responses of conservation tasks, a scoring key was prepared. For every item four scores were possible, 0, 1, 2 and 3. One who could not give correct judgment response was given zero. One who could give correct judgment but no correct explanation was given 1 point. The subjects who could give correct judgment but not completely satisfactory explanation was given 2 points and who could give correct judgment and full justification of equality or inequality was given a score of 3. This procedure was used after discussing it with a number of experts in Piagetian theory.

All the data of tryout was scored in the above manner. After scoring, item analysis was attempted. Two aspects were considered in item analysis: (i) index of difficulty and (ii) discrimination power. To find the index of difficulty of an item, total score of each age group on that item was expressed as a percentage of total possible score on that item. For example in the case of conservation of length item No. I, total score of 7 year olds is 2. Dividing this by 60 (total possible score for 20 children) and multiplying by 100, a percentage of 3.33 was obtained. For this age group, the difficulty value of the item is 3.33%. In the same way indices of difficulty of all the tasks (items) of spatial egocentrism and conservation of length and conservation of area were calculated. Only those items were considered to be suitable which were within the range of 15% to 85%. All the tasks/item showed difficulty values in this range for the age groups 10 and 11.

Calculation of discrimination power of items was based on Piaget's assumption that a child should perform better with higher age, since perceptual role taking (reverse of spatial egocentrism), and conservation are developmental phenomena. Instead of attempting any discrimination index, an order of ascent of score with increase in age was considered. The subjects of six age groups were

re-grouped in three: 7-8, 9-10 and 11-12 years. Total scores of each of these three age group (each consisting of 40 children) were calculated, and means were found. To have visual representation, bar graphs were prepared. It was found that all the four items or task of spatial egocentrism were suitable from this point of view.

There was a regular ascent of scores with increase in age in the case of each item of conservation task also.

To save time 2 items (one of equality and another of inequality) were deleted from each part of conservation. Only 8 items each to assess conservation of length and conservation of area, were retained in the final forms.

Inter-score and test retest reliability of all the three tools were found and results have been given below. These indices were calculated on the basis of data collected from 30 children aged 10.

Indices Tools	Test-retest reliability	Inter scores reliability
Percep. role-taking	.96	.83
Conserv. of length	.97	.94
Conserv. of area	.94	.91

It was found that difficulty level of each of the three tools as a whole was about 50% in the age group of 10 and this age group was taken up for the final study. It was also found that all the test items (tasks) showed appropriate difficulty value at this age level. 10 year old children were taken from grade 5 of Municipal Corporation Primary Boys Schools.

All the Municipal Corporation Primary Boys Schools of New Delhi South Zone were listed alphabetically and about 50% of the schools were selected with the help of random table and taken up for the main study. 37 schools out of 75 Municipal Corporation Primary Boys Schools were selected. In each school an alphabetical list of the subjects studying in grade 5 and aged 10 years was prepared. 50% of the children from each list were selected at random. In this way 307 children were selected from 37 schools. But due to absenteeism of some of the selected children only 280 children could be covered. Each child was tested in three consequtive working days. On the first day Raven's coloured Progressive Matrices was administered. On the second day tasks of spatial egocentrism and on the third day tasks of conservation of length and conservation of area were administered.

The administration was done during the period May 1977 to March 1978. It was done within a single academic session 1977-78.

RESULTS

Scores of perceptual role taking, intelligence, conservation of length and conservation of area were available. As the study was concerned with the question of interrelationship between these four measures, use of product moment coefficient correlation was thought to be an appropriate technique. Use of this type of correlation is justified only if the regression lines are linear. Eta coefficients were calculated for all the six pairs of variables and linearity of regression was tested in terms of Chi-square. It was found that in four pairs of variables one regression line was non-linear. The idea of using product moment correlation was given up. Contingency coefficients were calculated for each pair of measures to find the degree of correlation between the variables. Following are the contingency coefficient for different pairs of variables, each calculated from a 5 x 5 contingency table:

Perceptual role taking and conservation of length = .70

Perceptual role taking and conservation of area = .71

Intelligence and conservation of length = .44

Intelligence and conservation of area = .46

Intelligence and perceptual role taking = .52

Conservation of length and conservation of area = .76

All the C's were positive[*] and significant at .01 level. The C's between perceptual role taking and conservation of length, between perceptual role taking and conservation of area and between conservation of length and conservation of area were quite high as the maximum value of C possible for 5 x 5 contingency table is .894.

As intelligence was positively correlated with perceptual role taking conservation of length and conservation of area so it was thought that a positive correlation between (a) perceptual role taking and conservation of length, (b) perceptual role taking and conservation of area, and (c) conservation of length and conservation of area could be explained to some extent on the basis of a third factor (intelligence). So an attempt was made to control intelligence and to find what would be the correlation if all the subjects had more or less the same level of intelligence. 139 subjects whose scores on intelligence test fell within a range of Mdn ± Q were selected. Contingency coefficients were calculated for the three pairs of variables from 5 x 5 contingency tables. The results have been given below:

(1) Perceptual role-taking and conservation of length.

C (Intelligence not controlled) = .70

C (Intelligence controlled) = .68

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[*] Discussed in Chapter V.

(2) Perceptual role taking and conservation of area.

C (Intelligence not controlled) = .71

C (Intelligence controlled) = .65

(3) Conservation of length and conservation of area.

C (Intelligence not controlled) = .76

C (Intelligence controlled) = .75

There was a slight reduction in the values of contingency coefficients, still all the C's could be considered as high and positive.

Perceptual role taking is highly and positively correlated with conservation of length and with conservation of area. The tasks of Flavell et al. (1968) which have been used in this study, were used by Flavell et al. for measurement of perceptual- role - taking skill. The same tool has been used by Rubin (1973), for the measurement of spatial egocentrism. It has already been discussed that before a subject can take some body else's perceptual - role; he should come out of his spatial egocentric shell. Spatial egocentrism may be taken as converse of perceptual role taking. As such it may be taken that spatial egocentrism is highly and negatively correlated with conservation of length and conservation of area.

LIMITATIONS OF THE STUDY

Before drawing any conclusion on the basis of the

results of this study, it will be appropriate to mention some of the limitation of the study. Two of them have been mentioned below:

(1) In this study it has been found that perceptual role taking is highly and positively correlated with conservation of length and with conservation of area. But no attempt has been made to find whether there is causal relationship. On the basis of this study it would not be possible to say that a development of perceptual role taking hence loss of spatial egocentrism is the cause of development of conservation of length and area. However, it may be logically argued that a subject should come out of his spatial egocentric shell and develop ability to observe multiple relationship of an object before he can become a conserver. (Piaget 1952).

(2) Another limitation of the study is that no attempt has been made to find whether development of conservation of length and conservation of area take place simultaneously or there is some time gap between the two. For example from Piaget's experiments of beaker or container used in the assessment of conservation of liquid quantity, it was found that at earlier ages children can focus their attention only on one dimension (either on the height of the narrow container or on the width of the wide container) at a time. In the case of conservation of length the

child has to take into account only one aspect (length) while in conservation of area consideration of two dimensions - length and width - are required, logically it can be argued that conservation of length develops earlier than conservation of area. So it seems probable that conservation of length develops first then conservation of area. But the time gap between the development of these two skills is probably very short giving the impression that conservation of the two develop, more or less at the same time. However no attempt has been made by the investigator to answer this interesting question.

CONCLUSIONS

It may be mentioned here that the study was conducted in Municipal Corporation Primary Boys' Schools of New Delhi (South Zone) and that it covered only 10 plus children reading in V grade. The study also covered only boys and not girls. Only one form of egocentrism i.e. spatial egocentrism has been investigated. These delimitation of the study were mentioned while selecting the problem and these delimitations should be kept in mind when drawing conclusions. The conclusions will be applicable only in the case of spatial egocentrism and not the other type of egocentrism like communicative egocentrism,

role taking egocentrism, cognitive egocentrism etc. In the same way findings will be applicable only to two aspects of conservation - conservation of length and conservation of area - and not other aspects, such conservation of number, weight, mass, volume etc. Findings of this study are applicable to 10 plus boys studying in grade V. Whether the findings of this study will be applicable in the case of girls or other age groups or in other geographical areas will remain open questions to be answered by further investigations in the field.

Keeping the reservations, as mentioned above, in mind, the following conclusions are being drawn.

(1) Spatial egocentrism is highly and negatively correlated with one who is highly spatial egocentric is likely to be a bad conserver of length and one who shows low level of spatial egocentrism is likely to be a good conserver of length. As the correlation is very high these will be a few exceptions for this general trend.

(2) Spatial egocentrism is also highly and negatively correlated to conservation of area one who is highly spatially egocentric is likely to be a bad conserver of area and one who shows low level of spatial egocentrism is likely to be a good conserver of area. As the correlation is very high there will be a few exceptions to this general trend.

(3) Intelligence is moderately and positively related to conservation of length one who is high in intelligence is likely to be good conserver of length and one who is in intelligence is likely to be a bad conserver of length. As the correlation is not very high there will be some exceptions to this general trend.

(4) Intelligence is moderately and positively correlated to conservation of area one who is high in intelligence is likely to be a good conserver of area, and one who is low in intelligence is likely to be a bad conserver of area. As the correlation is not very high, there will be some exceptions to this general trend.

(5) Intelligence is moderately and negatively related to spatial egocentrism, one who is high in intelligence is likely to be less spatial egocentric and who is low in intelligence is likely to show high spatial egocentricity. As the correlation is not high, there will be same exception to this general trend.

(6) Conservation of length and conservation of area are highly and positively related. So a good conserver of length is very likely to be a good conserver of area. Only a few exceptions to this general trend will occur as the correlation is high.

SUGGESTIONS FOR FURTHER STUDIES

Any investigation answers only a few questions and very often that too is done partially, emphasising that further investigations in the same area will be necessary. Following are some of the suggestions for further studies.

(1) Replication of the study in other regions of Delhi as well as in other places outside Delhi will be necessary to confirm, modify or reject the findings of this study.

(2) The same study may be conducted with girls.

(3) The same study should be repeated with other age groups.

(4) Some comparative studies may be taken up to find out whether there is a sex difference in spatial egocentrism, conservation of length and conservation of area.

(5) A study may be taken up to see if there is any causal relation between (a) spatial egocentrism and conservation of length and (b) spatial egocentrism and conservation of area.

(6) A properly planned longitudinal or cross sectional study may be taken up to find if conservation of length develops earlier than the conservation of area and, if so, what is the time gap.

(7) Studies with factorial design may be taken up to find relation between spatial egocentrism, conservation (conservation of length and area) and other environmental factors like SES, family discipline, school etc.

(8) Attempt may be made to develop suitable training programme for development of perceptual role - taking, conservation of length and conservation of area. Experimental studies may be taken up to evaluate effectiveness of such training programmes.

BIBLIOGRAPHY

ns, D.C. (1965) 'Statistics: An introduction for students in behavioral sciences', Charles E. Merrill Book, Inc.

ey, F.H. (1975) 'The development of Piagetian paper and pencil test for assessing concrete operational reasoning', Dess. Abst., 35, 9, 558IA-628IA (5947-A).

s, J.B., Kohr, M.E., and Ayers, M.N. (1974) 'Perceptual motor skills, ability to conserve and school readiness', Percept. Mot. Skills, 38. 491-494.

r, E.A. (1971), 'Conservation and two related cognitive functions', Dess. Abst. Int., 1971, 31 (8-B), P. 4965.

- Haee, M.A. and Hosseini, A.A. (1971) 'Conservation of quantity attained by Iranian elementary school children in Iran', Psych. Rep., 29, 282-288.

- Haee, M.A., Mehryer, A.H. & Sabharwal, V. (1972) 'The correlation between Piaget's conservation of quantity tasks and three measures of intelligence in a select group of children in Iran', J. Psych., 80, 197-201.

d, R.M. (1960) 'The nature and development of concepts', Ed. Rev. (Birmingham), 13, 12-26.

in, H. (1968) 'Cognitive capacities of young children: A replication, Science, 162, 920-924.

i, U.K. (1976) 'Concept of speed a development-cum-training study', Unpublished Ph.D. Thesis, I.I.T. Delhi.

yne, D.R. (1957) 'Recent development in Piaget's work', Bril. J. Ed. Psych., 27, 1-12.

dwaj, S.K. (1969) 'Construction of the test battery to assess number readiness of children of age group 4½ to 6½ years studying in pre-primary schools of Delhi, Unpublished M.Ed. Dessertation, Jamia Millia Islamia, New Delhi.

ia, C.M. (1955) 'Bhatia's battery of performance tests of intelligence', Vaman D. Purohit & Sons, 126 Shivaji Nagar, Poona.

Borke, H. (1971) 'Interpersonal perception of young children egocentrism or empathy?', Dev. Psych., 5, 263-269.

Borke, H. (1975) 'Piaget's Mountains Revisited: Changes in the egocentric landscape', Dev. Psych., 11, 240-243.

Bowd, A.D. (1974) 'Factorial independence of perceptual egocentrism', Percept. Mot. Skills, 38, 453-454.

Brain , M.D.S. (1959) 'The ontogeny of certain logical operations. Piaget's formulation examined by non verbal methods, Psych. Mon. Gen. & Appl., 73, 5, (Whole No. 475).

Brain, M.D.S. (1964) 'Development of a group of transitivity of length: A reply to Smedslund, Child Developm., 35, 799-870.

Brain, M.D.S. and Shanks, B.L. (1965) 'The conservation of shape property and a proposal about the origin of conservation', Can. J. Psych., 19, 197-207.

Bruner, J.S. (1964) 'The course of cognitive growth', Am. Psych., 1964, 19, 1-15.

Bruner, J.S., Olver and Greenfield (1966) 'Studies in cognitive growth', New York: Wiley.

Cameron, P. (1967) 'Introversion and egocentricity among the aged', J. Geronot., , 22, 465-468.

Chandler, M.J. (1971) 'Egocentrism and antisocial behavior: The assessment and training of social perspective taking skills', Dev. Psych., 9, 326-332.

Chandler, M.J. and Greenspan S. (1972) 'Ersatz egocentrism: A reply to H. Borke; Dev. Psych., 7, 104-106.

Church, J. (1961) 'Language and the discovery of reality: A development psychology of cognition,' New York: Vintage,

Coie J.D., Costanzo, P.R. and Farnill, D. (1973) 'Specific transitations in the development of spatial perspective-taking ability; Dev. Psych., 9, 167-177.

Cowan, P.A. (1966) 'Cognitive egocentrism and social interaction', Am. Psych., 21, 623.

Cox, M.V. (1975) 'The other observer in a perspective task', Brit. J. Ed. Psych., 45, 83-85.

Cox, M.V. (1977) 'Perspective ability: The condition of change', Child Developm., 48, 1724-1727.

Cox, M.V. (1977) 'Perspectives ability: the relative difficulty of the other observer's view points. J. Exp. Child Psych., 24, 254-259.

Delemos, M.M. (1969), 'The development of conservation in aboriginal children', Int. J. Psych., 4, 225-269.

Deutsch, F. (1974) 'Observational and sociometric measures of Peer popularity and their relationship to egocentric communication in female preschoolers', Dev. Psych., 10, P. 745.

DeVries, R. (1974) 'Relationship among Piagetian IQ, and achievement assessments', Child Developm., 45, 746-756.

DeVries R. (1970) 'The development of role-taking as reflected by behavior of bright average and retarded children in a social guessing game', Child Developm., 41, 759-770.

Dodwell, P.C. (1960) 'Children's understanding of number and related concepts', Can. J. Psych., 14, 191-205.

Dubois, P.H. (1965) 'An introduction to psychological statistics', Harper & Row, Publisher.

Dudek, S.Z. Leslie E.P., Goldberg, J.S. and Dyer, G.B. (1969) 'Relationship of Piaget measures to standard intelligence and motor scales', Percept. Mot. skills, 28, 351-362.

Eliot, J. and Dayton, C.M. (1976) 'Factors affecting accuracy of perception on a task requiring the ability to identify viewpoints', J. Gen. Psych., 128, 201-214.

Elkind, D. (1961a) 'Children's discovery of the conservation of Mass, Weight and Volume: Piaget replication study II', J. Gen. Psych., 98, 279-287.

Elkind, D. (1961b) 'Quantity conception in junior and senior high school students', Child Developm., 32, 551-560.

Elkind, D. (1967a) 'Egocentrism in adolecence', Child Developm., 38, 1025-1035.

Elkind, D. (1967b), 'Piaget's conservation problemsf, Child Developm., 38, 15-27.

Elkind, D. & Schoenfeld, F. (1972) 'Identity and equivalence conservation at two age levels', Dev. Psych., Vol. 6, 529.

Flavell, J. (1963) 'The Developmental psychology of Jean Piaget', Princeton NJ: Van Nostrand.

Flavell, J.H., Botkin, P.T., Fry, C.L., Wright, J.W. and Jarvis, P.E. (1968) 'The development of role taking and communication skills in children', John Wiley and Sons, Inc.

Feffer, M. (1959) 'The cognitive implications of role-taking behavior', J. Per., 27, 152-168.

Feffer, M. (1970) 'The developmental analysis of inter-personal behavior', Psych. Rev., , 77, 197-214.

Finley, G.H., Solla J. and Cowan P.A. (1977) 'Field - dependence - independence, egocentrism and conservation in young children' J. Gen. Psych., 131, 155-156.

Fishbein, H.D., Lewis, S., and Keiffer, K. (1972) 'Children's understanding of spatial relations: coordination of perspectives. Dev. Psych., 7, 21-33.

Feigenbaum, K.D. (1963) 'Task complexity, and IQ variables in Piaget's problem of conservation', Child Developm., 34, 423-432.

Freud, A. (1965) 'Normality and pathology in childhood: Assessment of Development', New York, International Universities Press.

Freud J.E. (1960) 'Modern elementary statistics', Prentice Hall Series Inc. Englewood Cliffs NJ.

Garette, H.E. (1947) 'Statistics in psychology and education! New York: Longmans.

Garner J. and Plant, E.L. (1972) 'On the measurement of egocentrism: A replication and extension of Aeblis' findings', Brit. Jr. Ed. Psych., 42, 79-83.

Gaudia, G. (1972) 'Race, social class and age of achievement of conservation of Piaget's tasks', Dev. Psych., 6, 158-165.

Goldschmid, M.L. (1967) 'Different types of conservation and their relation to age sex, IQ, MA and vocabulary', Child Developm., 38, 1229-1249.

Goldschmid, M.L. and Bentler, P.M. (1968) 'The dimensions and measurement of conservation', Child Developm., 39, 787-802.

Goldschmid, M.L., Bentler, P., Kohnstamm, G., Modgil, S.L. (1973) 'A cross-cultural investigation of conservation', J. Cross-Cult. Psych., 4, 49-75.

Graves, A.J. (1972) 'Attainment of conservation of mass weight and volume in minimally educated adults', Dev. Psych., 7, 223-224.

Gray, W.M. (1973) 'Development of a Piagetian based written test: a criterion - referenced approach', paper presented at the annual meeting of American Educational Research Association, New Orleans, February.

Greenfield, P.M. (1966) 'On Culture and conservation' in Bruner J.S. et al. 'Studies in cognitive growth', New York: Wiley, , 225-256.

Greenfield P.M. and J.S. Bruner (1971) 'Learning and language: Work with the Wolof, Psych. Today, 5, 40-43.

Green, M.W. and Evert, J.C. (1955) 'Normative data on Progressive Matrices (1947)'; J. Consult. Psych., 19, 139-142.

Green, D.R., Ford, M.P. and Flamer, G.B. (1971) 'Measurement and Piaget'. New York: McGraw-Hill

Gruen, G.E. (1966) 'Note on conservation and definitional consideration', Child Developm., 37, 977-983.

Guilford, J.P. (1956) 'Fundamental statistics in psychology and education. McGraw-Hill Book Company, Inc.

Hardman, M. and Peisach E. (1977) 'conservation of equality and inequality', J. Gen. Psych., 31, 157-158.

Hollos, M. and Cowan, P.A. (1973) 'Social isolation and cognitive development: Logical operations and role-taking abilities in three Norwegian social settings', Child Developm. 44, 630-641.

Hooper, F.A. (1969) 'Piaget's conservation tasks. The logical and developmental priority of identity conservation', J. Exp. Child Psych., 8, 234-249.

Huttenlocher, J. & Presson C.C. (1973) 'Mental rotation and perspective problem', Cog. Psych., 4, 277-299.

Inhelder B. and Piaget J. (1958) 'The growth of logical thinking from childhood to adolescence ', New York: Basic Books.

Inhelder, B., Sinclair, H. and Bovet, M. (1966) 'On cognitive development', Am. Psych., 21, 160-164.

Jalota, S. (1953) 'Test of general mental ability in Hindi,' Psycho Centre, T-22, Green Park, New Delhi.

Kalra, V. (1978) 'A study of moral judgment in children belonging to different mental, socio-economic levels', Unpublished Ph.D. Thesis, Jamia Millia Islamia, New Delhi.

Kingsley, R.C. and Hall, V.C. (1967) 'Training Conservation through the use of learning sets', Child Developm., 38, 1111-1125.

Kanudson, H.M. and Spencer, K. (1977) 'Visual perspective, role-taking and field - independence among Anglo American and Maxican American Children', J. Gen. Psych., 131, 243-253.

Kohlberg, L., Yaeger, J. & Hjertholm, E. (1968) 'Private speech: four studies and a review of theories', Child Developm., 39, 691-736.

Kohlberg, L. & DeVries, R. (1974) 'Relations between Piaget and psychometric assessment of intelligence', in Lavatelli, C.S. 'The natural curriculum of the Child, Urbana: University of Illinois Press.

Kuppuswamy, B. (1962) 'Manual of socio-economic status scale', Manasayan, Delhi.

Kurdeck, L.A. and Rodgon, M.M. (1975) 'Perceptual, cognitive and affective perspective taking in kindergarten through sixth-grade children', Dev. Psych., 11, 643-650.

Lal, S. (1948), Allahabad intelligence tests: Manovigyanshala, U.P. Allahabad, India.

Lindquist E.F. (1940) 'Statistical analysis in Educational research'. Boston: Houghton Miffin.

Lister, C.M. (1972) 'The development of ESN childrens' Understanding of conservation in a range of attribute situation', Brit. J. Psych. 42, 14-22.

Lister C.M. and Klien R.E. (1973) 'The effect of stimulus familiarity on the conservation performance of rural guatemalan children', J. Soc. Psych., 90, 197-205.

Lloyd, B.B. (1971) 'Studies of conservation with Yoruba children of differing ages and experience', Child Developm., 42, 415-428.

Looft, W.R. (1972) 'Egocentrism and social interaction across the life span', Psych. Bull., 78, 73-92.

McNemar Q. (1962) 'Psychological statistics', John Wiley & Sons Inco.

Mehler, J. and Bever, T.G. (1967) 'Cognitive capacity of very young children', Science, 158, 141-142.

Mermelstien, E. Carr, E., Mills, D. and Schwartz, J. (1967) 'Training techniques for the concept of conservation', Alberta J. Ed. Psych., 13, 185-200.

Mermelstien, E. and Shulman, L.S. (1967) 'Lack of formal schooling and the acquisition of conservation', Child Developm., 38, 39-52.

Minichiello, M.D. and Goodnow, J.J. (1969) 'Effect of an action cue on conservation of amount', Psych. Science, 16, 200-201.

Moynahan, E. and Glick, J. (1972) 'Relation between identity, conservation and equivalence conservation within four conceptual domains', Dev. Psych., 6, 247-257.

Muhar, I.S. and Jain, U. (1969) Development of conservation in rural urban school children', Psych. Rev. 6, 45-49.

Mwangangi, R. (1975) 'The cognitive development of Kenya Affrican children as shown by their performance on selected Piagetian tasks of conservation', Dess. Abs. International, A-5001.

Neale, J.M. (1966) Egocentrism in institutionalized and noninstitutionalized children, Child Developm., 37, 97-101.

Nilima (1974) 'Standarization of number readiness test constructed (By P. Seth, 1972-73) to assess number readiness for children of age group'. unpublished M.Ed. Dessertation, Jamia Millia Islamia.

Northman, J.E. and Gruen, G.E. (1970) 'Relationship Between identity and equivalence conservation', Dev. Psych., 2, 311.

Okonji, M.O. (1971) 'Culture and children's understanding of geometry, Int. J. Psych., 6, 121-128.

Page, A. (1974) 'Conservation of identity and equivalence among children from varying socio-economic background', cited in Psy. A bstract, 51 , 4864.

Papalia, D.E. (1972) 'The status of several conservation abilities across-the life span', Human Developm., 15, 229-243.

Papalia, D.E. and Hooper, F.H. (1971) 'A developmental comparision of identity and equivalence conservation', Jr. Expt. Child Psych., 12, 347-361.

Peisach, E. and Wein, N. (1970) 'Relationship of conservation explanations to item difficulty', J. Gen. Psych., 117, 167-180.

Phatak, P. (1966) 'Draw - a man test for Indian children', Dandia Bazar, Baroda.

Piaget, J. (1926) 'The language and thought of the child', London: Routledge and Kegan Paul, (French Ed. 1923).

Piaget J. (1928) 'Judgment and reasoning in the child', London: Routledge and Kegan Paul,(French Ed. 1924).

Piaget, J. (1932) 'The moral judgment of the child', London: Routledge and Kegan Paul (French Ed. 1932).

Piaget, J. (1950) 'The psychology of intelligent', London: Routledge and Kegan Paul (French Ed. 1947).

Piaget J. (1952) 'The child's conception of number', London: Routledge and Kegan Paul (French Ed. 1941).

Piaget, J. (1953) 'The origin of intelligence in the child', London: Routledge and Kegan Paul (French Ed. 1936).

Piaget J. (1956) 'The child's conception of space', London: Routledge and Kegan Paul (French Ed. 1948).

Piaget, J. (1960) 'Equilibrium and the development of logical structures': Discussion of Child Developm., Vol. IV, P. 103.

Piaget, J. (1962) Quoted by Flavell J.H., Botkin, P.T., Fry, C.L. Wright, J.V. and Jarvis, P.E. in 'The Development of role-taking and communication skills in children', John Wiley and Sons Inc., 1968, P.17.

Piaget, J. (1964) 'Development and learning', 'in Ripple R.E. and Rockcastle V.N. (Eds.), 'Piaget rediscovered: A report of the conference on cognitive studies and corriculum development', Ithaca School of Education, Cornell University, P. 7-20.

Piaget, J. (1968) 'Quantification, conservation and nativism: Quantitative evaluations of children aged two to three years are examined,' Science, 162, 976-979.

Piaget, J., Inhelder, B. and Szeminska A. (1960). 'The child's conception of geometry', London: Routledge and Kegan Paul (French Ed., 1948).

Piaget, J. and Inhelder, B. (1969) 'The psychology of the child'. London: Routledge and Kegan Paul (French Ed. 1966).

Pratoomaraj, S. and Johnson, R.C. (1966) 'Kinds of questions and types of conservation tasks as related to children's conservation responses', Child Developm., 37, 343-353.

Rao, S.N. (1976a) 'Conservation of different quantities in children of high and low ability level', India Jr. Psych. 1951, 291-301.

Rao, S.N. (1976b) 'An experimental investigation of children's concepts of mass, weight, and volume, Indian J. Psych., 51, 212-220.

Raven, J.C. (1947) 'The Coloured Progressive Matrices Sets A, Ab and B', 1963 revision. London: Lewis.

Rothenberg, B.B. (1969) 'Conservation of number among four-and five-year-old children: Some methodological consideration', Child Developm., 40, 383-404.

Rothenberg, B.B. and Courtney, R.C. (1968) 'Conservation of number in very young children: A replication of and comparision with Mehler and Bever's study', J. Psych., 70, 205-212.

Rubin, G. (1971) 'Reduction of egocentrism in chronic Schizophrenic patients as a factor of conservation learning tasks', Dess. Abstr. Inter. 1971, 31, (18-B) 5007-5008.

Rubin, K.H. (1973a) 'Egocentrism in childhood: A unitary construct?', Child Developm., 44, 102-110.

Rubin, K.H. (1973b) 'Decentration skills in institutionalized and noninstitutionalized elderly', Proceedings of the 81st Annual convention of the American psychological association. Montreal, Canada, Vol. 8, 763-764.

Rubin, K.H. (1973c) 'Relationship between egocentric communication and popularity among peers', Dev. Psych., 7, 364.

Rubin, K.H.,Attewell, P.W., Jierney and Tumolo, P. (1973) 'Development of spatial egocentrism and conservation across the life span', Dev. Psych., 9, 432.

Rubin, K.H. and Schneider, F.W. (1973) 'The relationship between moral judgment and egocentrism and altruistic behavior', Child Developm., 44, 661-665.

Rubin, K.H. (1974) 'The relationship between spatial and communication egocentrism in children and young and old adults', J. Gen. Psych., 125, 295-301.

Sawada, D. and Nelson, L.D. (1967) Conservation of length and the teaching of linear measurement: A methodological critique', Arithmatic Teacher, 14, 345-348.

Selman, R.L. (1971) 'The relation of role-taking to the development of moral judgment in children', Child Developm., 42, 79-91.

Seth, P. (1973) 'Construction of number readiness test to assess number readiness in children of age 5½ years studying in primary schools of Delhi', un-published M.Ed. Dessertation, Jamia Millia Islamia, New Delhi.

Shantz, C.U. & Watson J.S. (1971) 'Assessment of Spatial Egocentrism through expectancy violation', Psychonomic science, 18, 93-94.

Siddiqui M.N. and Bhandari, K.S. (1977) 'Studies on the cognitive development of primary schools students in science concepts', School Science, 15, 35-39.

Siegel, S. (1956) 'Non parametric statistics for the behavioral sciences, McGraw-Hill Kogakiusha, Ltd.

Siegel, L.S. and Goldstein, A.G. (1969) 'Conservation of number in young children: Recency versus relational response strategies', Dev. Psych., 1, 129-130.

Sigel, I.E. Roeper, A and Hooper F.H. (1966) 'A training procedure for acquisition of Piaget's conservation of quantity: A pilot study and its replication', Brit. J. Ed. Psych., 36, 301-311.

Simoonsson, R.J. (1973) Egocentric responses of normal and emotionally disturbed children in different treatment settings', Child Psychiatry and Human Development, 3, 179-186.

dslund J. (1961) 'The acquisition of conservation of substance and weight in children III. Extinction of conservation of weight acquired "normally" and by means of empirical controls on a balance', Scan. J. Psych. 2, 85-87.

edslund, J. (1961) 'The acquisition of conservation of substance and weight in children: I. Introduction', Scan. J. Psych., 1961, 2, 11-20.

edslund, J. (1963) 'Development of concrete transitivity of length in children', Child Developm., 34, 389-405.

latas, H. and Flavell J.H. (1976) 'Perspective taking: the development of two components of knowledge', Child Developm., 47, 103-109.

rauss, S. and Langer, J. (1970) 'Operational thought inducement', Child Developm., 41, 163-175.

ddenham, R.D. (1970) 'A "Piagetian" test of cognitive development', In: Dookrell, B. (Ed.) 'On intelligence'. Toronto: Ontario Institute for Studies in Education, PP. 49-70 London: Methuen.

rang, J.P. (1979) Developing instructional strategies for teaching Hindi as a second Language to the urdu medium students of Delhi on the basis of an identification of variables involved in the different aspects of Hindi attainment of Urdu medium children', unpublished Ph.D. Thesis, Jamia Millia Islamia, New Delhi.

nner, J.M. and Inhelder B. (1958) In 'discussion on Child Developm., Vol. III, 114, and 154-162.

giris, I.C. (1964) 'Situational generality of conservation', Child Developm., 35, 831-201.

ernon, H.C. & Kingsley, R. (1968) Conservation and equilibrium theory', Jr. of Gen. Psych., III, 195-213.

gotsky, L. (1962) 'Thought and language', Cambridge Mass: M.I.T., Press.

llach, L. and Sprott, R.L. (1964) 'Inducing number conservation in children', Child Developm., 35, 1057-1071.

Walker, L.D. and Collin, E.S. (1977) 'Perspective role-taking in young children', J. expt. child Psych., 24, 343-357.

Walker, H. Lev. J. (1953) Statistical Inferences, New York: Holt.

Warren, H.C. (1934) 'Dictionary of Psychology'. Houghton Miffin Comp.

Wasik, B.H. and Wasik, J.L. (1971) 'Performance of culturally deprived children on the concept assessment kit-conservation', Child Developm., 42, 1586-1590.

West, H. (1974) 'Early peer-group interaction and role taking skills: An Investigation of Israeli Children', Child Developm., 45, 1118-1121.

Winkelman, W. (1975) cited by Modgil S.O. in 'Piagetian Research', Vol. IV NFER Publishing Company.

Yule G.U. and Kendall, M.G. (1958) An introduction to the theory of statistics', Charles Griffin and Company Ltd. London.

Za'rour, G.I. (1971a) 'Conservation of Weight across different materials by Lebanese school children in Beirut', Sci. Ed. 55, 387-394.

Za'rour, G.I. (1971b) 'The conservation of number and Liquid by Lebanese school children in Beirut', J. Cross cult. Psych., 2, 165-172.

Zimiles, H. (1966) 'The development of conservation and differentiation of number' Monog. Soc. for Res. in Child Developm., 31, (6, Serial Number 108).

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APPENDIX - I

PIAGET'S THREE MOUNTAINS TASK*

A pasteboard model, one metre square and from twelve to thirty centimetres high, was made to represent three mountains. ... From his initial position in front of the model (A) the child sees a green mountain occupying the foreground a little to his right. The summit of this mountain is topped by a little house. To his left, he sees a brown mountain, higher than the green one and slightly to its rear. This mountain is distinguished not only by its colour but also by having a red cross at the summit. In the background stands the highest of the three mountains, a gray pyramid whose peak is covered in snow. From position C (opposite position A) a ZigZag path can be seen running down the side of the green mountain, while from position B (to the right of the model, relative to position A) a little rivulet is seen to descend the brown mountain. Each mountain is painted in a single colour except for the snow cap of the gray mountain, and the only reference points are those described.

The children are shown a collection of ten pictures, measuring 20 x 28 cm. These represent the mountains seen from different viewpoints and are painted in the same colour as the model. They are clearly distinguishable and are large enough for particular features such as the cross, the house and the snow - capped peak to be easily visible. The children are also given three pieces of card board, shaped and coloured the same as each of the mountains, and these may be arranged to represent the mountains as seen in a given perspective.

Finally, the appratus includes a wooden doll 2 or 3 cm. in hight. The head of the doll is a plain wooden ball with no face painted on it so that the child can ignore the doll's line of sight and need only consider its position. The doll is put in a number of different places and the child is asked to discover what perspective the doll will 'See' in each of the different positions. It is not the

---

*Reproduced from the book of Piaget, J. and Inhelder, B., (1956, PP. 210-212).

child who moves around the group of mountains - except to check his answers - but the doll which is supposed to be doing the travelling. The child has the problem of trying to imagine, an to reconstruct by a process of inference, the changes in perspective that will accompany the doll's movements, or the different positions which the doll must occupy to suit the various perspectives.

For this purpose we employed three separate but complementary methods of questioning the child. Firstly the child is given the three piece of shaped cardboard and asked to reconstruct the kind of 'snapshot' which could be taken of the group of mountains from position A, laying the pieces in appropriate positions on the table. Next, the doll is put at position C and the child asked to make the kind of picture, which the doll or he himself, could take from that position. This procedure is repeated for positions B and D. After this the child is told to sit at B (or C or D) and asked to show with the pieces of cardboard, the picture he could take from there. He is also asked to reconstruct the picture he has already made from A or other positions, he has occupied previously ...

In the second type of experiment we no longer ask the child to construct imaginary snapshots of the mountains, but show him the set of pictures asking him to pick out the one which is most suited to the view seen by the doll. As a rule, all the ten pictures are shown at the same time, though naturally the questions only deal with four or five positions to avoid boredom and rutine answers.

The third experiment is the converse of the second. Instead of trying to find the picture which corresponds to the position of the doll, the child selects one of the pictures and then decides what position the doll would have to occupy to take a snapshot similar to it. L

APPENDIX - II

TASK OF FLAVELL et al. (1968)*

INSTRUCTIONS GIVEN IN HINDI

"देखो यहाँ पर दो टेबुल हैं। हम इन दोनों टेबुलों पर एक खेल खेलेंगे। यह टेबुल (pointing to Table A) मेरी है, और यह टेबुल तुम्हारी (pointing to Table B) है। मेरी टेबुल पर एक आकृति/मॉडल रखा हुआ है जिसे मैं अपनी जगह से ध्यानपूर्वक देख रही हूँ। तुम्हारी टेबुल पर उसी तरह का एक लकड़ी का गुटका रखा है। साथ में एक कागज़ का टुकड़ा रखा है। तुम पहले ध्यानपूर्वक सुनो जो भी मैं कहूँगी और फिर बताना कि मैंने तुम्हें क्या करने के लिये कहा है।"

After this the main instruction was given: "तुम अपना गुटका/ब्लाक को अपनी टेबुल पर दिये गये कागज़ के टुकड़े पर इस तरह से रखो कि वह तुम्हें तुम्हारी जगह/तरफ से ऐसा ही दिखे जैसा कि मेरी टेबुल पर रखा गया गुटका/ब्लाक मुझे मेरी जगह से दिखाई पड़ रहा है।"

---

erials and procedures used in this task has been cussed in Chapter IV.

After completing this instruction the subject was asked:

"अब बताओ तुम्हें क्या करने के
लिए कहा गया है?"

If the child was not able to tell what he had to do, the same instruction was repeated and then he was asked what he had been expected to do. If the child still made incorrect response on the first attempt, he was asked to walk over to the observer's position and was instructed:-

"देखो यह आकृति/माडल इस जगह/तरफ
से जैसी दिखा रही है। जैसी यह
आकृति/माडल इस तरफ/जगह से दिखाई
दे रही है, वैसे ही तुम अपने गुटके/ब्लाक
को इस तरह से रखो कि वह तुम्हें तुम्हारी
जगह/तरफ से ऐसा ही दिखे। अपनी जगह
पर जाओ और ऐसा ही करो।"

If upon returning he still failed to orient the block researcher did it for him and explaining, it was correct. Then experimenter moved from side to opposite position (face to face with the subject) and the same main instructions were repeated .... Then display -2 was presented and the same main instructions were repeated.

APPENDIX - IVa

SCORES OF TEST AND RE-TEST ON THE TASK OF SPATIAL EGOCENTRISM

Code No.	Test	Re-test
1	8	5
2	17	16
3	14	16
4	15	14
5	16	13
6	19	18
7	8	7
8	19	15
9	10	8
10	26	30
11	7	10
12	32	31
13	15	14
14	12	12
15	6	9
16	11	9
17	12	13
18	20	25
19	14	16
20	18	17
21	26	29
22	11	13
23	10	9
24	8	9
25	13	15
26	22	23
27	15	17
28	21	18
29	29	28
30	8	10

Rho corrected for ties = .83

APPENDIX - IVb

TWO SETS OF SCORES ASSIGNED BY TWO JUDGES ON THE TASK OF SPATIAL EGOCENTRISM

Case No.	Judge I	Judge II
1	8	7
2	17	16
3	14	15
4	15	13
5	16	16
6	19	18
7	8	10
8	19	20
9	10	8
10	26	26
11	7	6
12	32	32
13	15	14
14	12	10
15	6	6
16	11	9
17	12	12
18	20	20
19	14	12
20	18	19
21	26	26
22	11	10
23	10	8
24	8	9
25	13	12
26	22	22
27	15	13
28	21	20
29	29	30
30	8	8

Rho Corrected for ties = .95

APPENDIX - V

TASKS OF CONSERVATION OF LENGTH
(English Version)

(a) Equality Tasks of Conservation of Length

Item No. 1:

Materials:

Two pencils - A and B equal in length (each 16 cm. long), shape and colour (Yellow).

Position of Objects Before Transformation*

In front of the subject both the pencils were placed horizontally on the table with their end-points in alingment. (Fig. 30a).

Transformation

Pencil B was shifted about 5 cm. toward the right hand side (Fig. 30b).

Question for Judgment:

"Now tell me, are the two pencils still equal in length or any one of them is shorter/longer than the other one?

Question For Explanation**

How did you know this?"

---

*In the case of each item of this type of tasks, before any transformation, the subjects were convinced that both the objects were equal in Length. This was done by placing the objects side by side before transformation.

**Explanation question was only asked when the subject responded correctly to question for judgment.

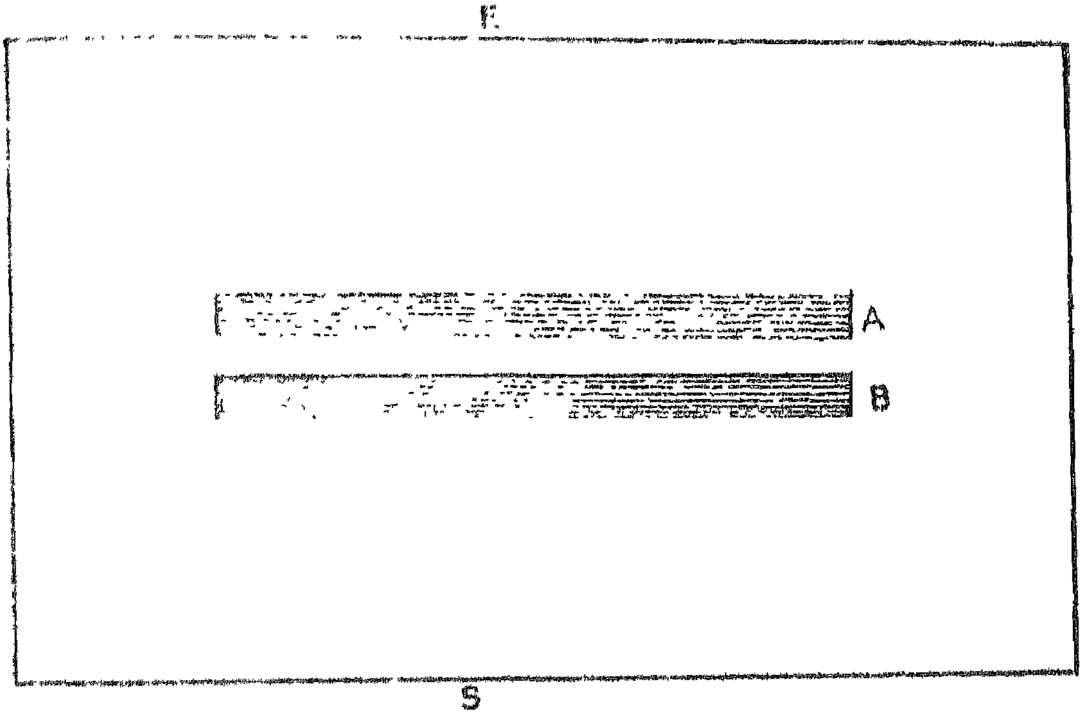


FIG.30a: POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO.1 (CONSERVATION OF LENGTH).

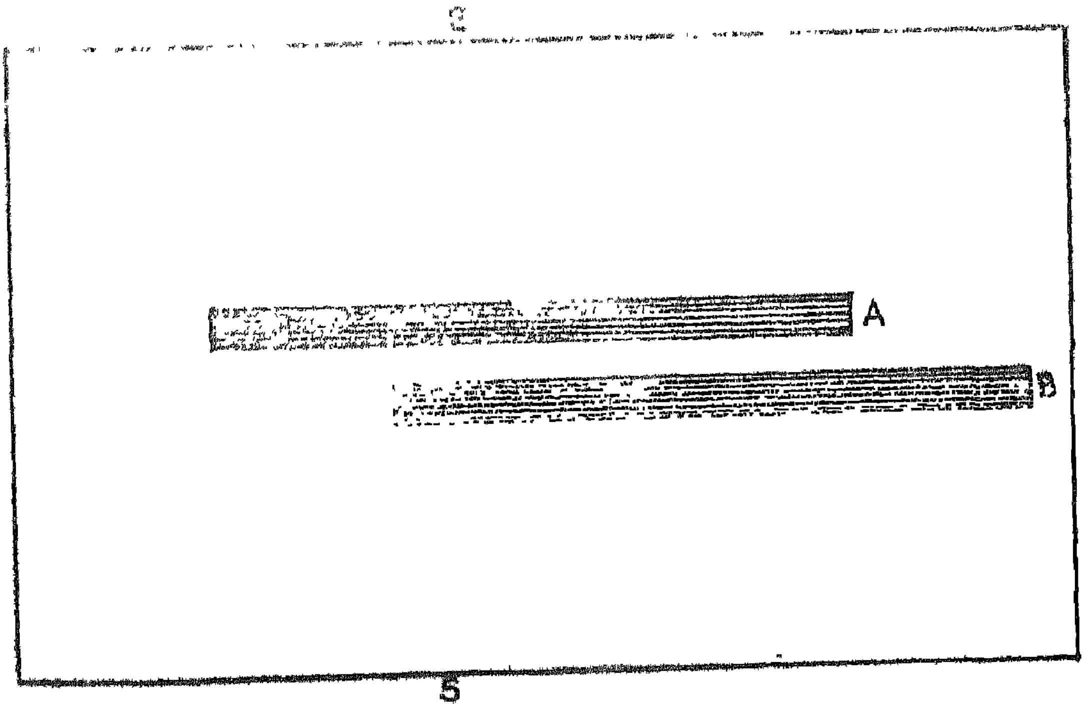


FIG30b: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO.1 (COSERVATION OF LENGTH).

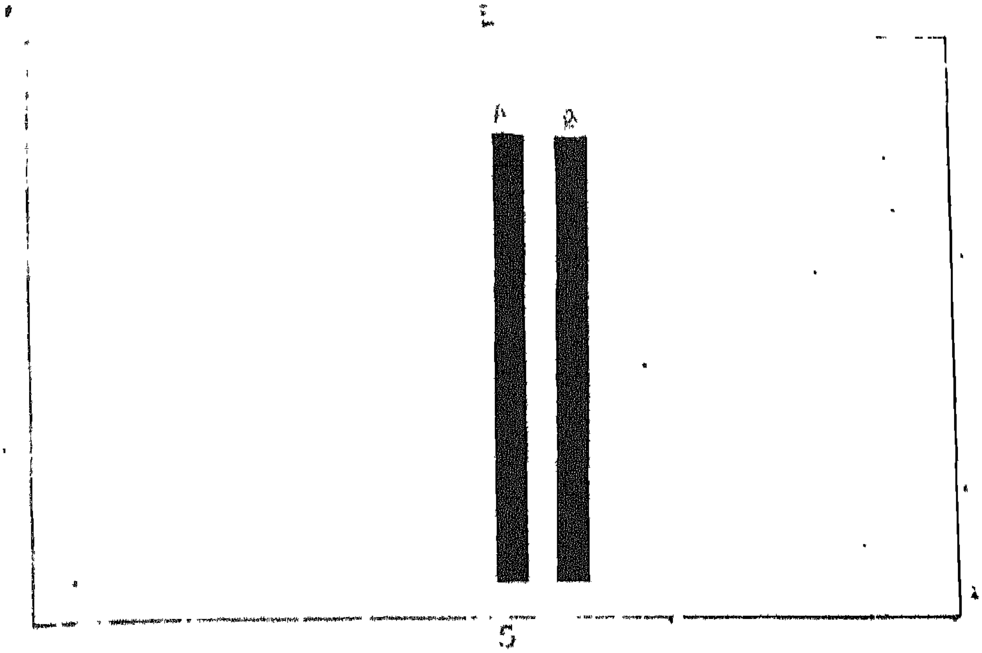


FIG 31 a : POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM [illegible] [illegible]ATION OF LENGTH).

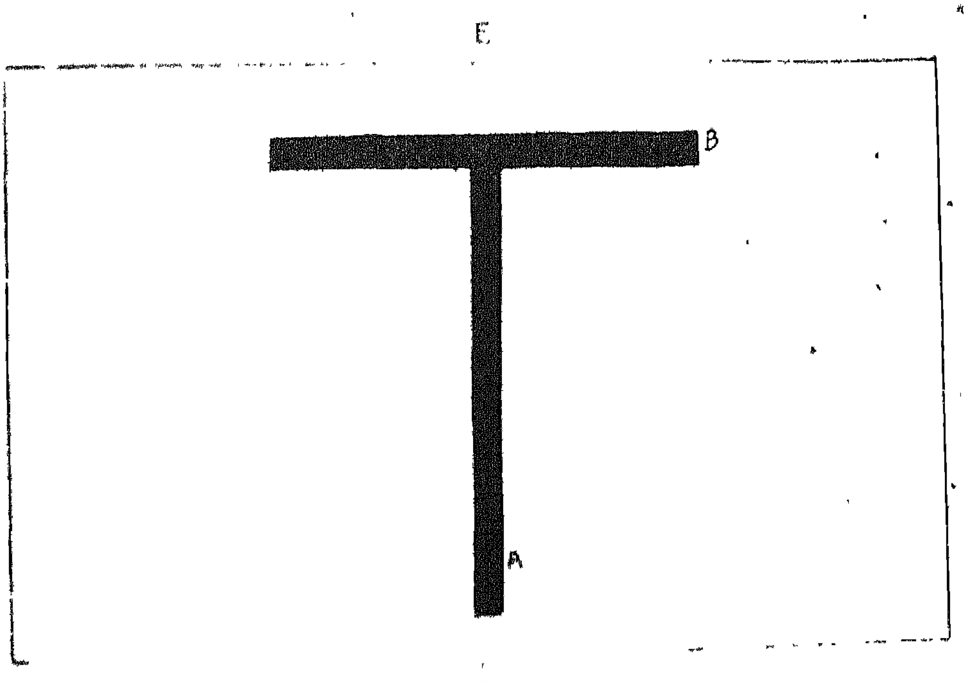


FIG 31 b : POSITION OF OBJECTS AFTER TRANSFORMATION [illegible] CONSERVATION OF LENGTH).

Item No. 3

Materials:

Two metalic rods - A and B, of exactly equal length (each 34 cm. long), shape and colour (steel gray)

Position of objects Before Transformation

Both the rods were placed on the table horizontally in front of the subject. The end - points of both the rods were in alignment (Fig. 32a).

Transformation

Rod B was moved to form the shape of ' 7 ' with rod A as shown in Fig. 32b.

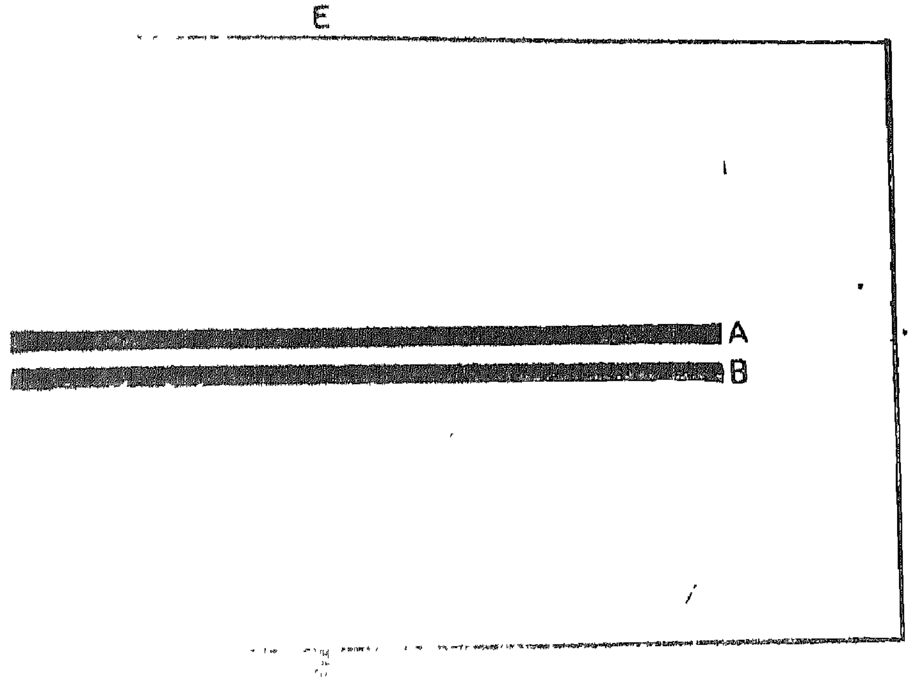
Question for Judgment

"Now tell me, are the both rods still equal in length or is any one of them longer/shorter than the other one?"

Question for Explanation

"How did you know this?"

[illegible]



[illegible] OF OBJECTS BEFORE TRANSFORMATION [illegible] NO. (CONSERVATION OF LENGTH).

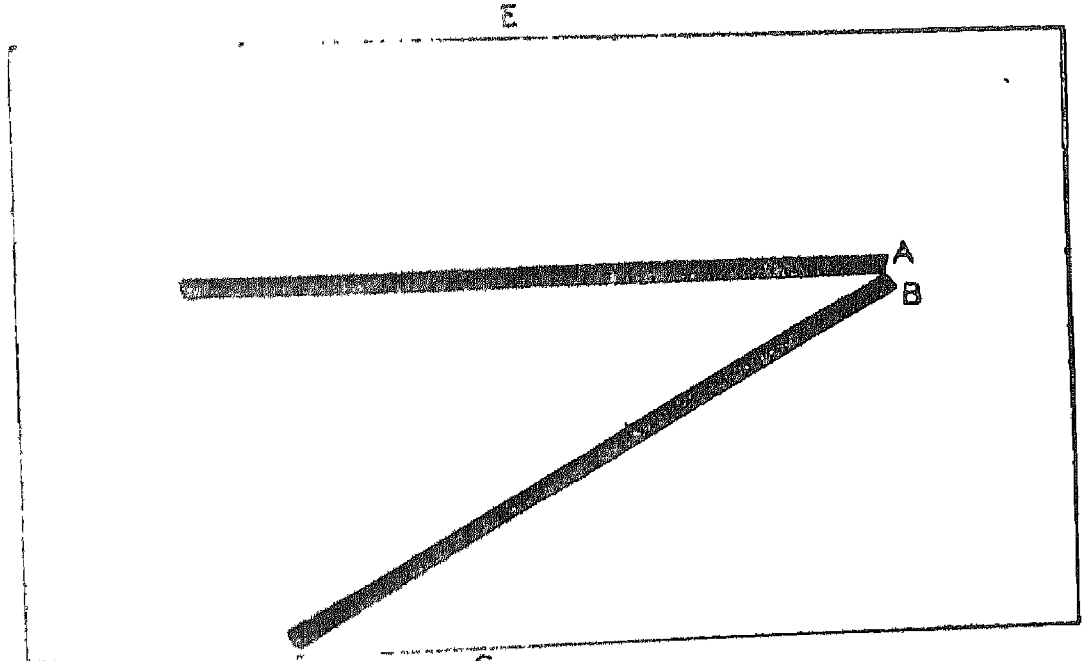


FIG. 32 B: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO 3 (CONSERVATION OF LENGTH).

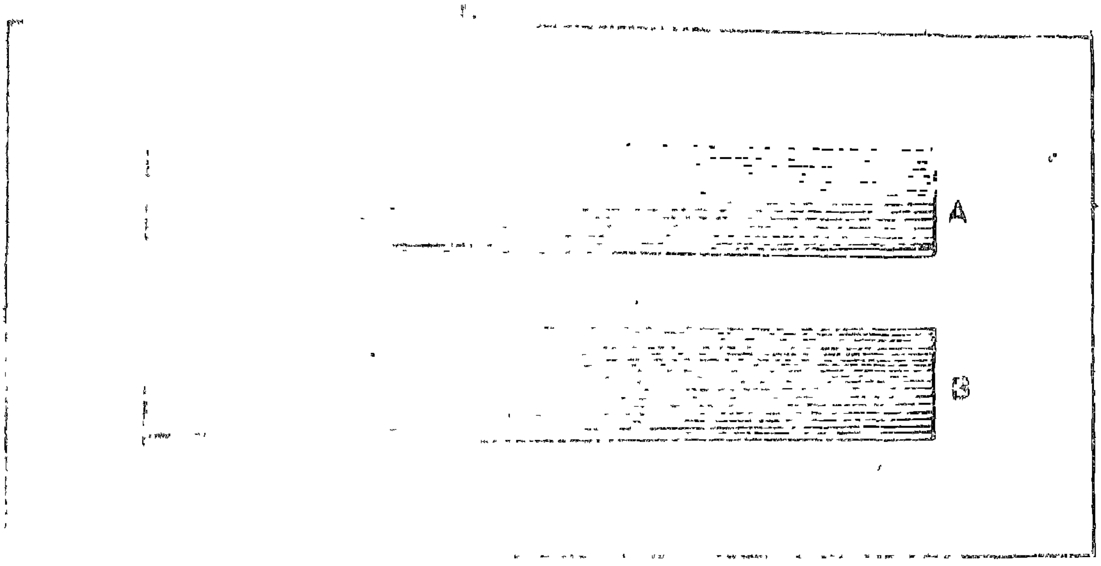


FIG. 33a: POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO. 4 (CONSERVATION OF LENGTH).

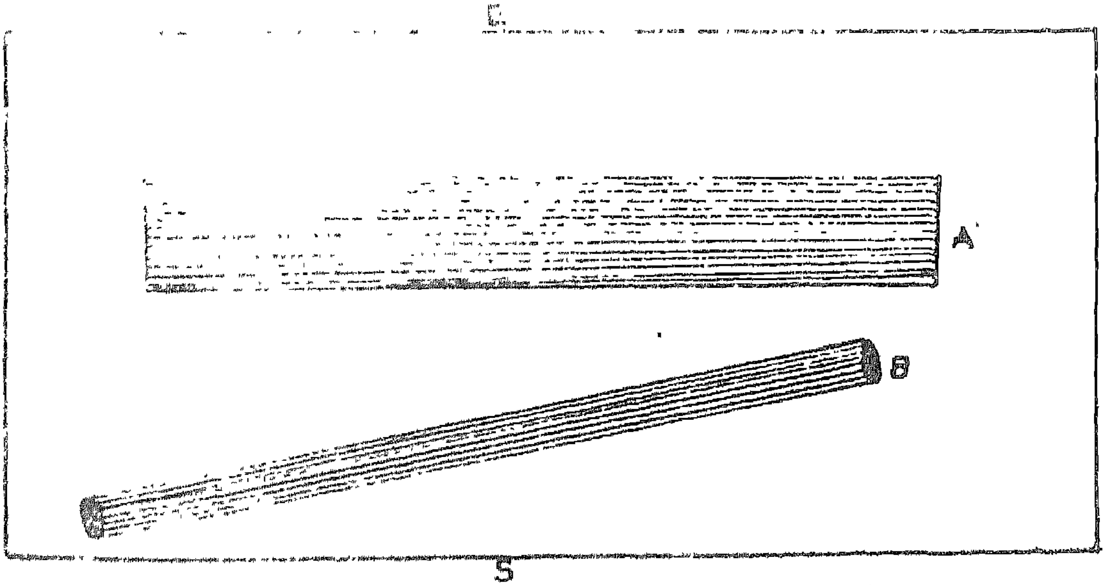


FIG. 33b: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 4 (CONSERVATION OF LENGTH).

Item No. 6

Materials

Two pieces of plastic wires (A and B) of exactly equal length (each 15 cm. long), shape and colour (red).

Position of Objects Before Transformation

The two pieces of wire were placed on the table in front of the subject horizontally with their end points in coincidance (Fig. 34a).

Transformation

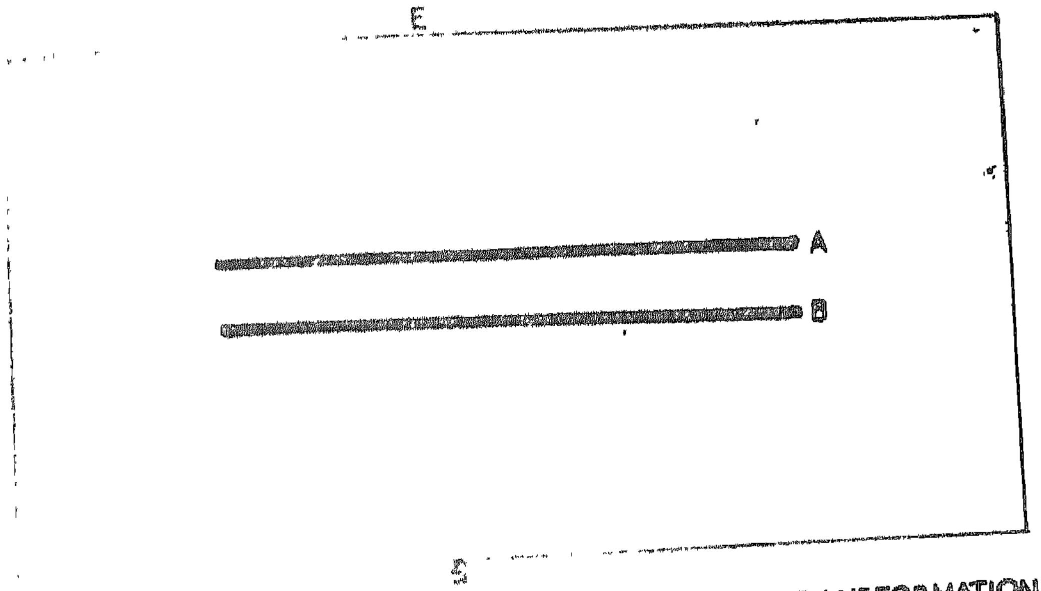
Wire B was twisted to make the shape of 'S' and placed in the position, as shown in Fig. 34b.

Question For Judgment

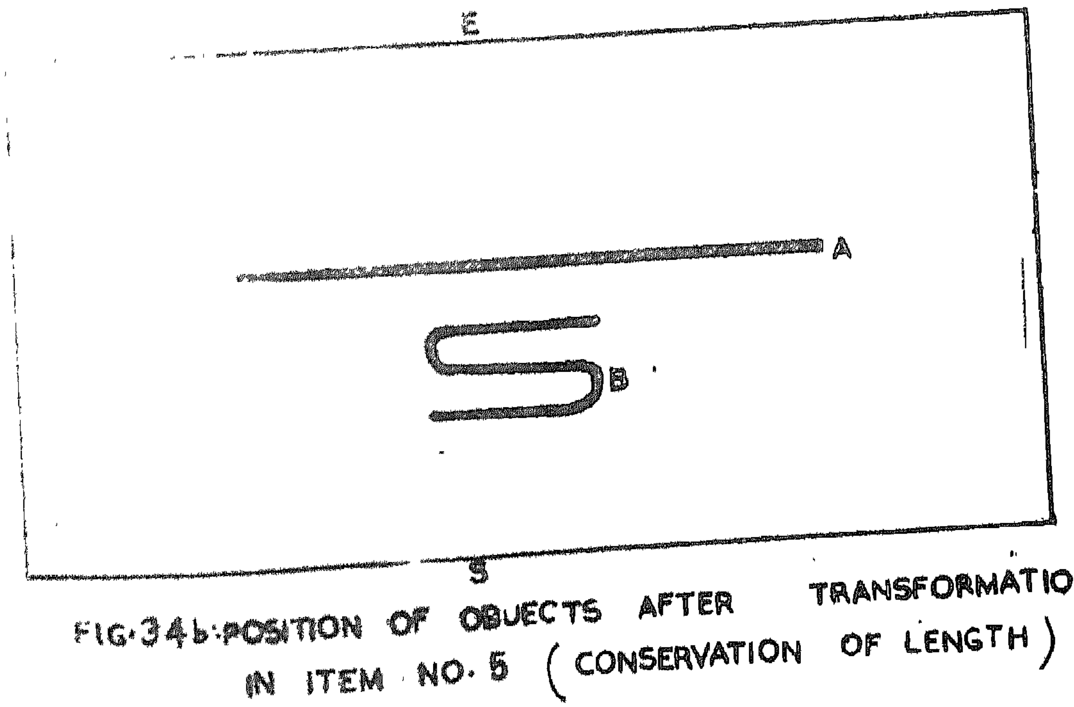
"Now tell me, are these two pieces of wires still same in size or is any one of them shorter/ longer than the other one?"

Question For Explanation

"How did you know this?"



FIG·34a·POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO 5 (CONSERVATION OF LENGTH).



FIG·34b·POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 5 (CONSERVATION OF LENGTH).

(b) [illegible] of Conservation of Length

Item No. 8

Materials

Two pieces of plastic wire, different in length (A=30 cm. long and B = 60 cm. long), but identical in diameter and colour (red).

Position of Objects Before Transformation*

Both wires were placed on the table in front of the subject as shown in Fig. 35a.

Transformation

Wire B was curved and placed in front of the Wire B, with their end points in approximately exact alignment (Fig. 35b).

Question For Judgment

Now tell me, are the both wires equal in length or is any one of them shorter/longer than the other one?**

Question for Explanation

"How did you know this?"

---

*In the case of each inequality item of conservation of length, before any transformation the attempt was made to convince the subject that both the objects were not equal in length by placing the objects in various arrangements.

**If the subject said that one wire is longer/shorter than the other one, then an addition question was asked. "point the wire which is Longer/Smaller than the other one?" After feeling correct answer experimenter proceeded to explanation question.

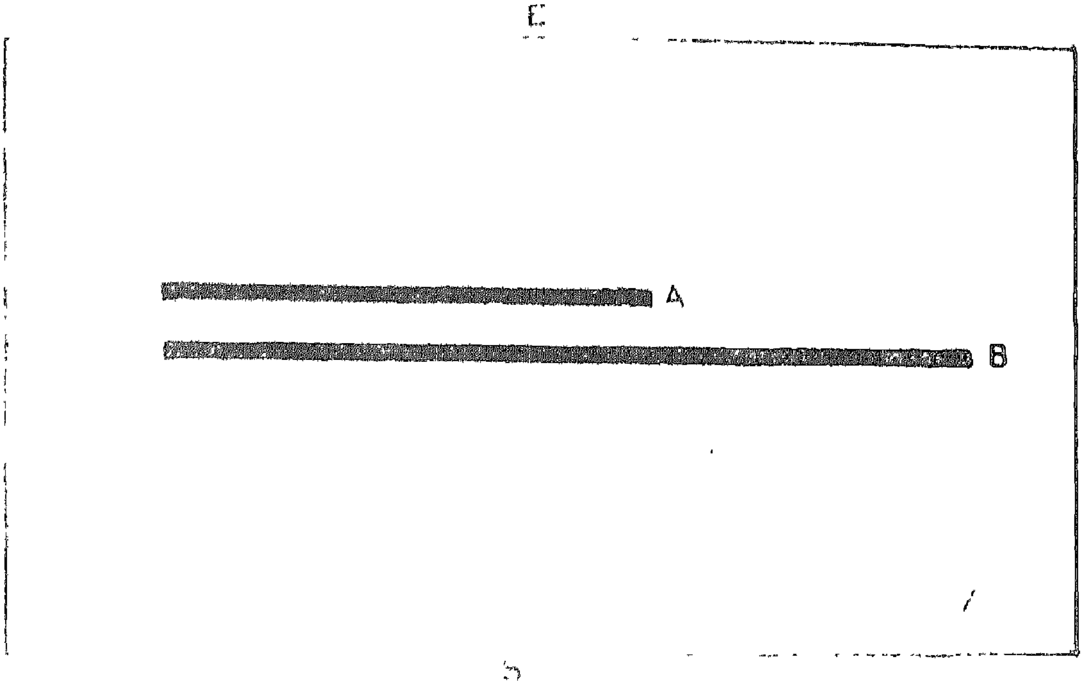


FIG.35: POSITION OF OBJECTS BEFORE TRANSFORMATIC IN ITEM NO.6 (CONSERVATION OF LENGTH).

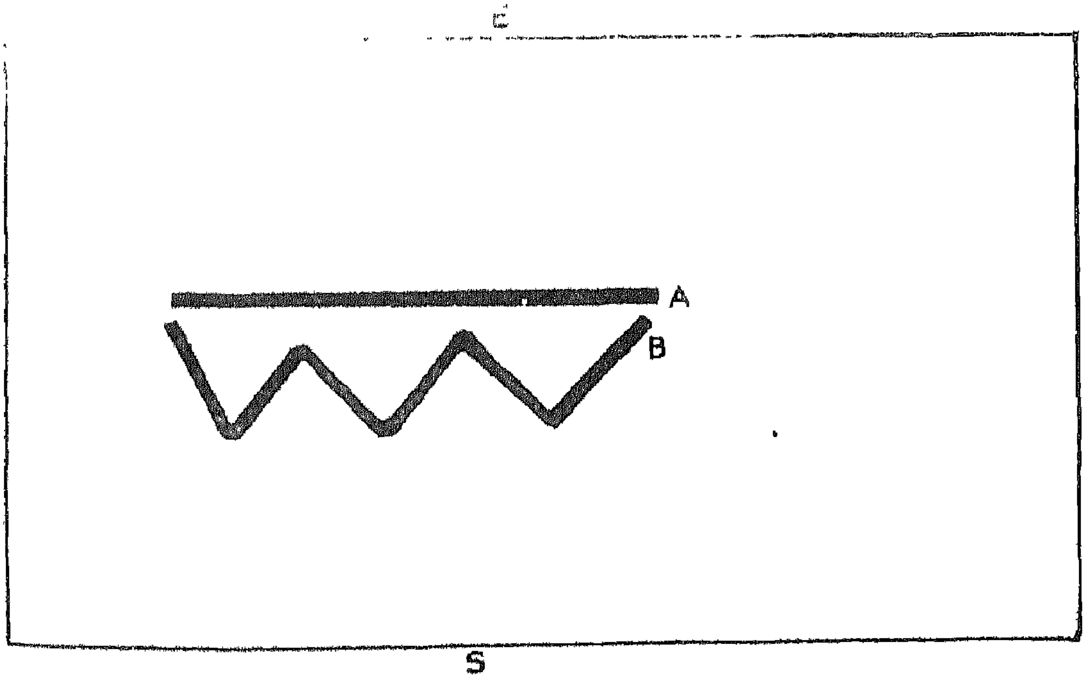


FIG.35: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO.6 (CONSERVATION OF LENGTH).

Item No. 7

Materials:

Two sausages of plasticine (A and B) inequal in length (A = 10 cm long, B = 20 cm. long). These samsages were similar in diameter and colour (green).

Position of objects Before Transformation

Both the sausages were placed on the table in front of the subject as shown in Fig. 36a.

Transformation

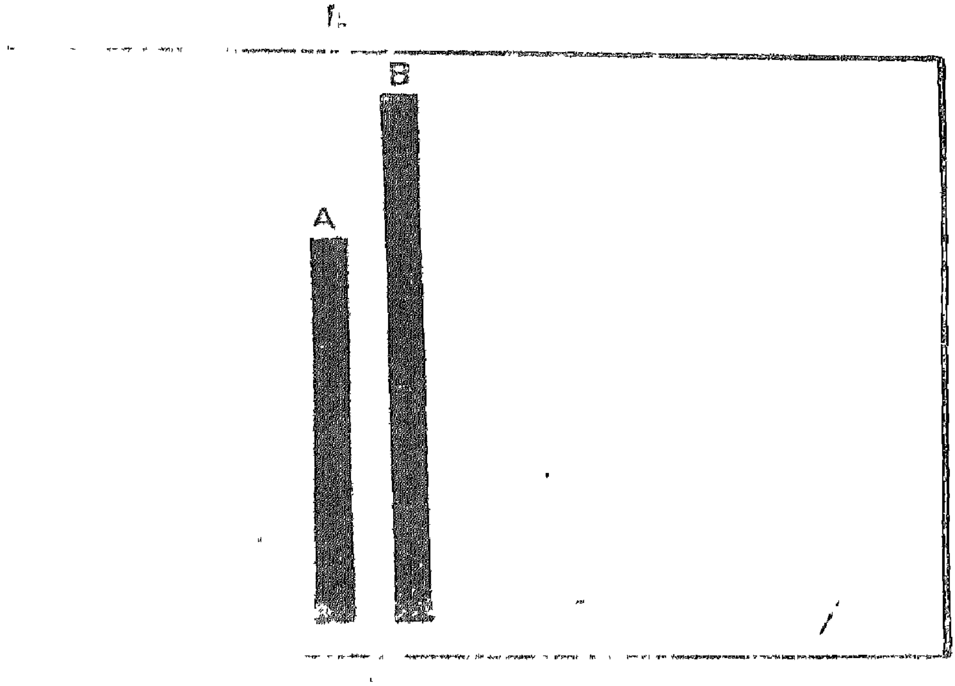
Sausage B was curved to make the shape of inverted 'U' (Fig. 36b).

Question for Judgment

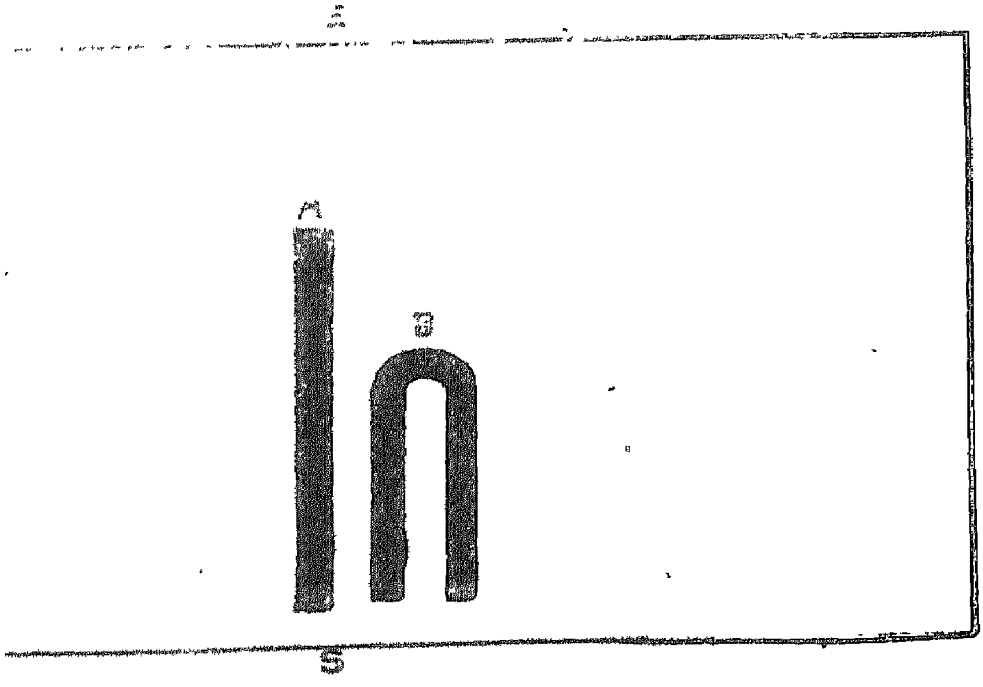
"Now tell me are the both sausages are equal in length or is any one of them shorter/longer than the other one?"

Question For Explanation

"How did you know this?"



a: POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO. 7 (CONSERVATION OF LENGTH).



b: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 7 (CONSERVATION OF LENGTH).

Item No. 8

Materials

Two threads inequal in length (A = 15 cm. long, B = 25 cm long). These threads were identical in diameter and colour (red).

Position of objects Before Transformation

Both the threads were placed on the table side by side virtically, in front of the subject (Fig. 37a).

Transformation

Thread B was twisted and placed in front the thread A as shown in Fig. 37b.

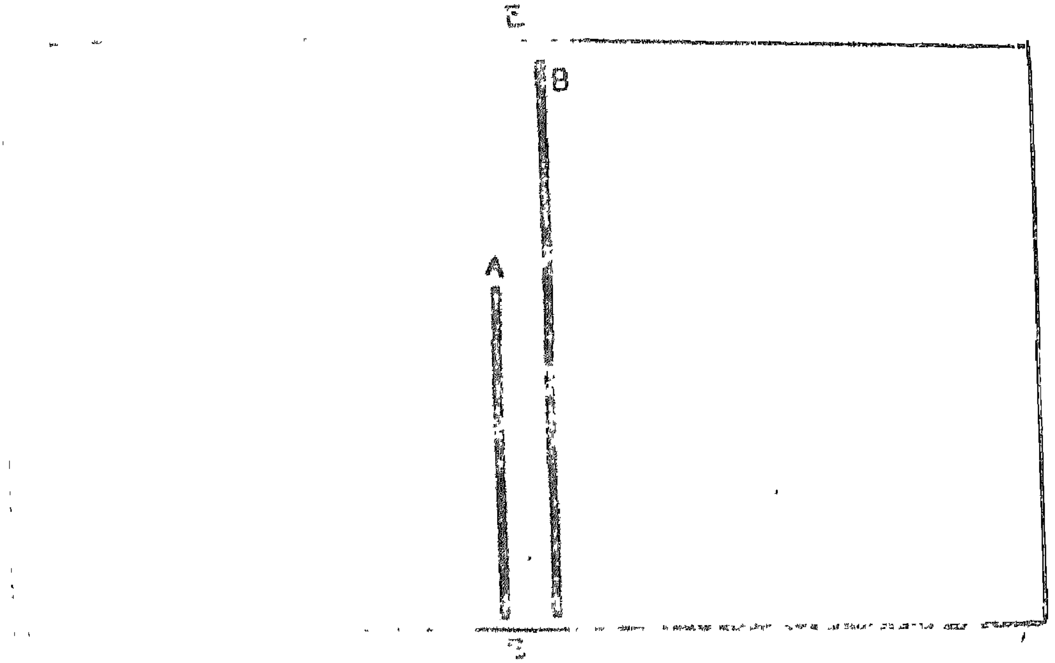
Question For Judgment

"Now tell me are these threads equal in length or is any one of them longer/shorter than the other one?"

Question For Explanation

"How did you know this?"

XXX A-



[illegible] OBJECTS BEFORE TRANSFORMATION
[illegible] (CONSERVATION OF LENGTH).

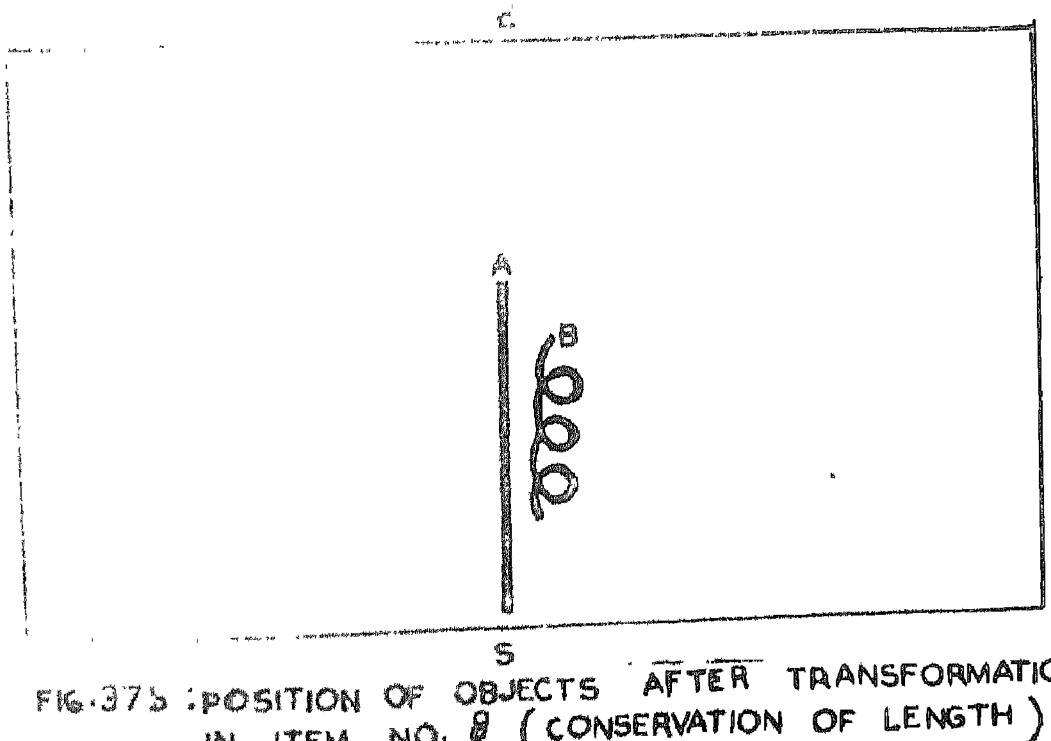


FIG.37b: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 8 (CONSERVATION OF LENGTH).

2

1

o pieces of papers inequal in length (A = 15 cm. B.). Both these pieces were similar in width cm.) and colour (white).

of Objects Before Transformation

front of the subject both of the pieces were side by side horizontally on the table (Fig. 38a).

rmation

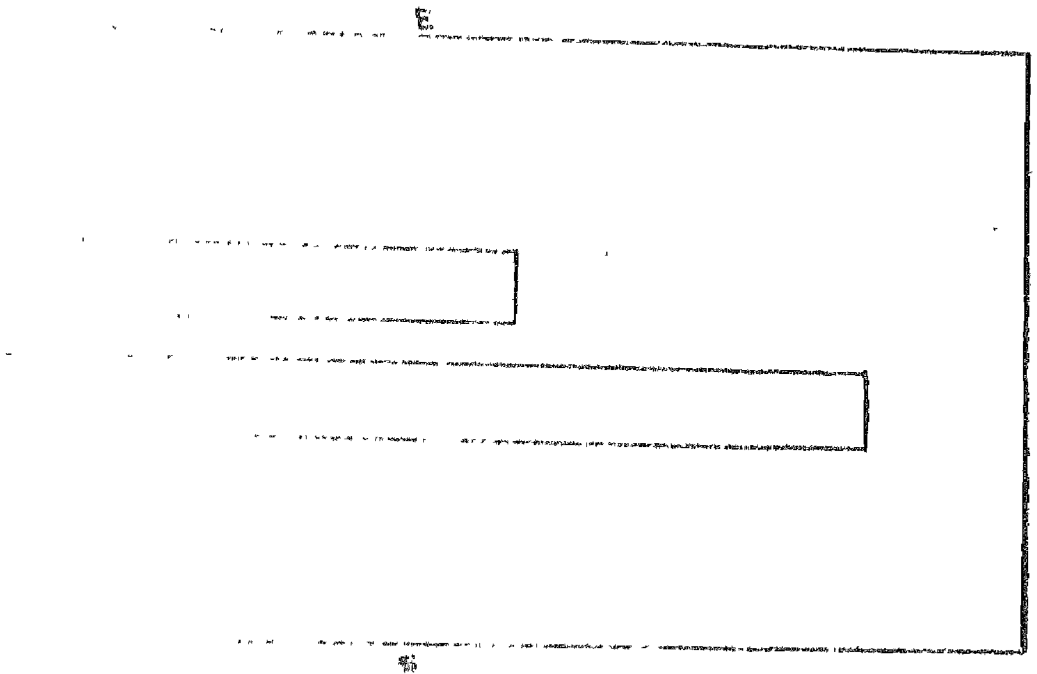
iece B was twisted and placed in front of piece own in Fig. 38b.

n For Judgment

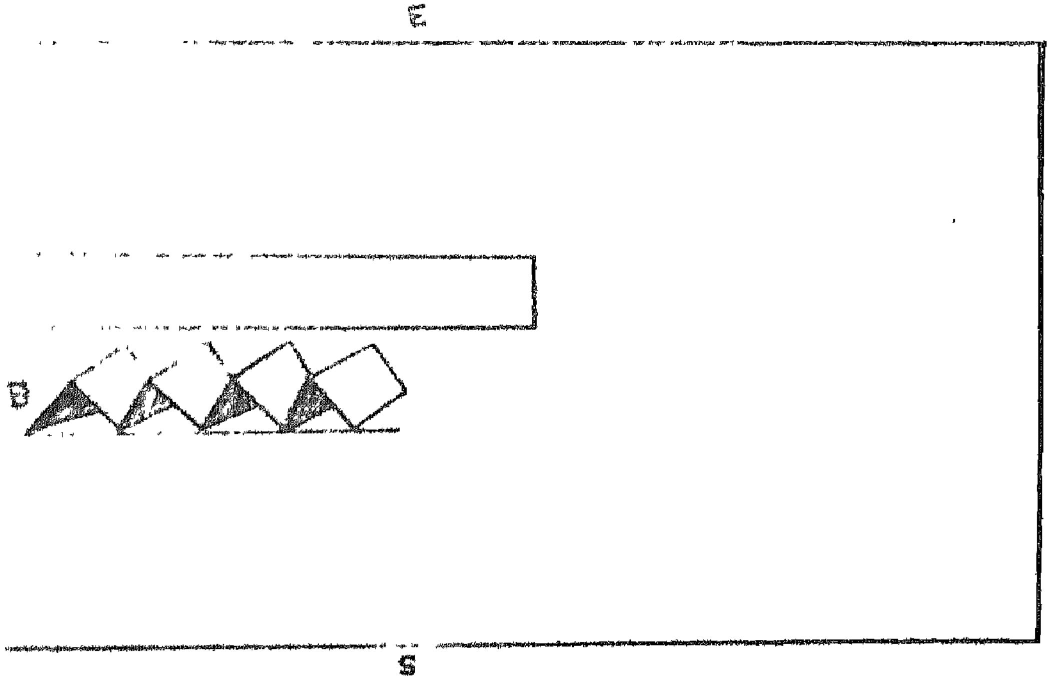
"Now tell me are these two pieces of paper equal gth or is any one of them longer/shorter than the one?"

on For Explanation

"How did you know this?"



a :POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO.9 (CONSERVATION OF LENGTH).



b :POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO.9 (CONSERVATION OF LENGTH).

Item No. 10

Materials

12 match sticks to make the line A and 15 match stick to make line B. All the match sticks were similar in length (approximately) shape and colour.

Position of Objects Before Transformation

Two lines A and B were made with the 12 and 15 match sticks respectively, (Fig. 39a).

Transformation

Line B was reconstructed to make the zigzag line as shown in Fig. 39 b.

Question For Judgment

"Now tell me are these two lines equal in length or is any one of them longer/shorter than the other one?"

Question For Explanation

"How did you know this?"

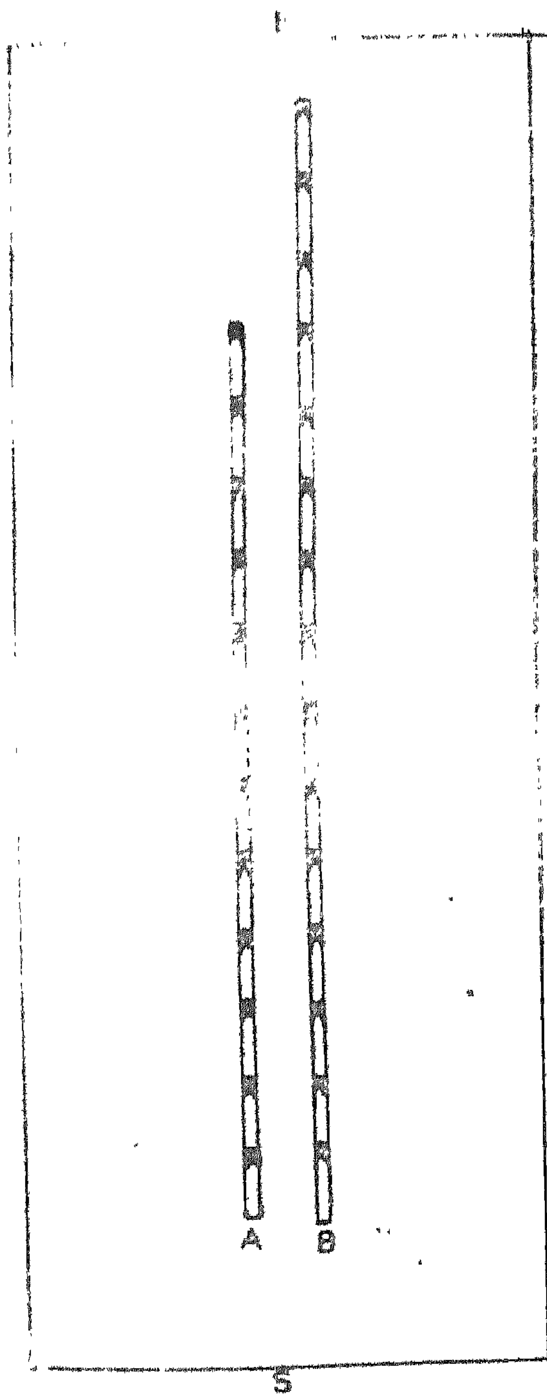


FIG. 39a: POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO. 10 (CONSERVATION OF LENGTH)

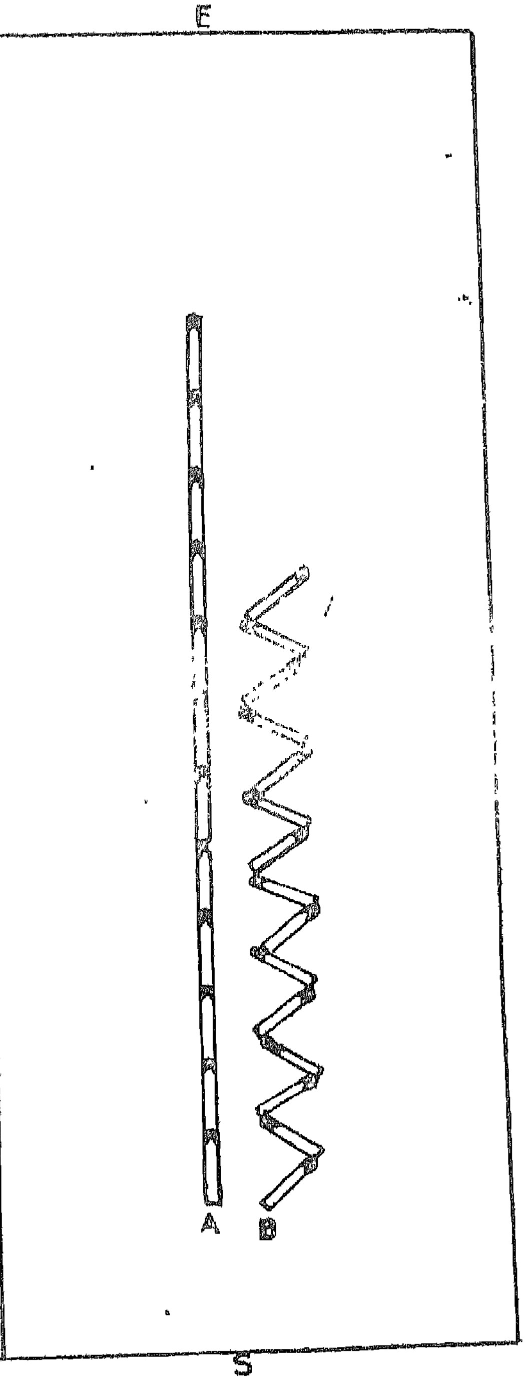


FIG. 39b: POSITION OBJECTS AFTER TRANSFORMATION. IN ITEM NO. 10 (CONSERVATION OF LENGTH)

TASKS OF CONSERVATION OF LENGTH

(HINDI VERSION)

Materials and procedures used in these tasks have already been described in the tasks of English Version. Following are the judgment and explanation questions that have been asked in the case of each item. Only in the case of judgment question names of the objects were different in all the ten items. Here only two examples will be given.

Item No. I

Question For Judgment

" अब तुम बताओ कि यह दोनों पेन्सिलें अब भी एक जितनी लम्बी हैं या इनमें से कोई पेन्सिल छोटी /बड़ी है ?"

Question For Explanation

" यह तुमने कैसे जाना ?"

Item No. 6

Question for Judgment

" अब तुम बताओ कि यह दोनों तार के टुकड़े एक जितने लम्बे हैं, या इनमें से कोई तार छोटा/बड़ा है ?"

Question for Explanation

" यह तुमने कैसे जाना ?"

APPENDIX - VI

TASKS OF CONSERVATION OF AREA

(English Version)

(a) Conservation Tasks of Meadows of Piaget et al. (1960)

In this type of tasks these were following six transformations which have been treated as six items:

Materials for all the six items

Two identical sheets of card board A and B (each measuring 30 cm. x 30 cm.) painted green to serve as meadows, eighteen 2.5 cm cubes to serve as small houses, and two small models of cow.

Illustration of equality of Sheets of Card-board and Cubes:

Green sheet B was superimpose on another green sheet A to show the subject that both were equal in size.

Equality of cubes was also shown to the subject by the same method.

Arrangement of objects before transformation I:

The two green squares were put side by side about 5 cm. apart, then a model of cow was placed on each green sheet as shown in Fig. 40a.

General Instructions to the Subjects

Pointing to the green sheets of card board the child was told "suppose these sheets are grass lands/meadows. As I have shown you, that they are equal in size, so in both meadows there is equal amount of grass also".

Then pointing to the models of cow the child was told "They are cows (placed in the centre of each square). Each cow has equal amount of grass to eat in their respective meadows."

Showing the wooden cubes the child was told "Look these are cubes, as I have shown you that they are equal in size. These cube will serve as small houses, Now tell me if a house is constructed on a meadow, would the some amount of grass reduce or remain the same?" After getting the correct answer the experimenter proceeded to Transformation I.

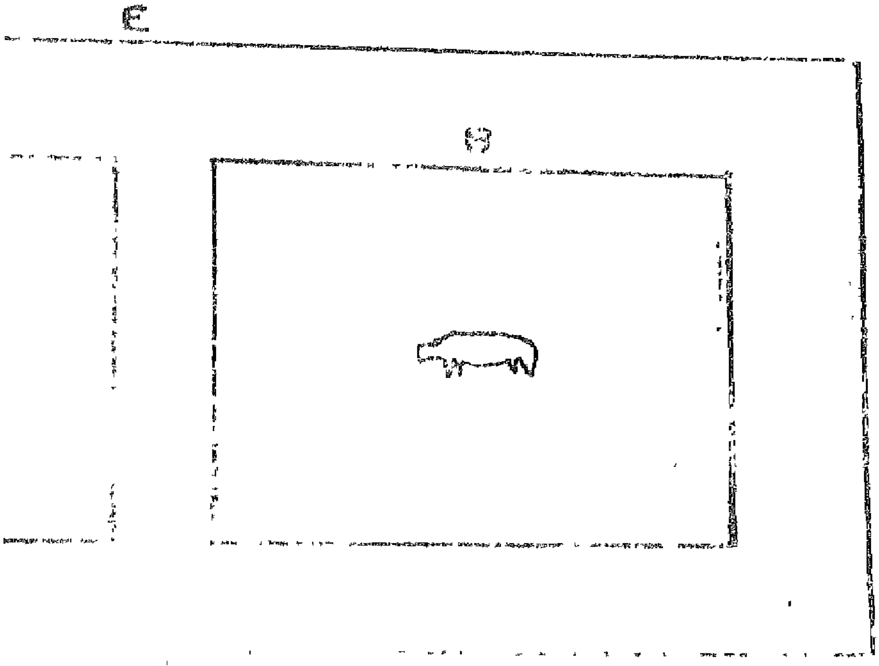
Item No. 1

Transformation 1:

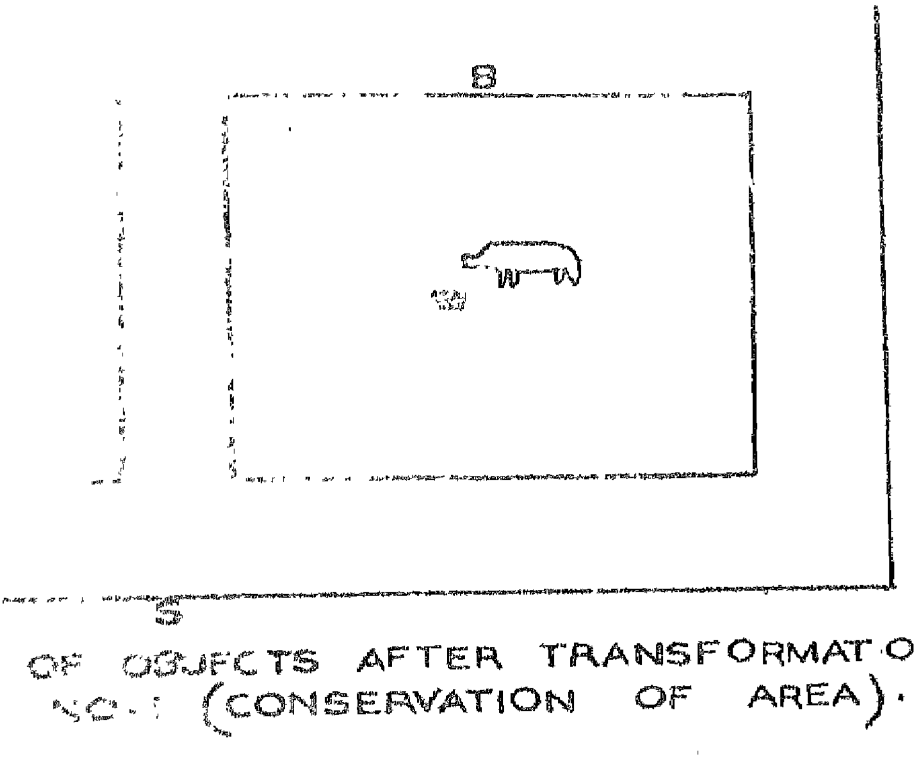
One cube was placed on each green sheet in the positions as shown in Fig. 40b.

Question for Judgment

'Now tell me, both the cows have still equal amount of grass to eat in their respective meadows, or is any



[illegible] BEFORE TRANSFORMATION
NO. 1 (CONSERVATION OF AREA).



OF OBJECTS AFTER TRANSFORMATION
NO. 1 (CONSERVATION OF AREA).

one having more/less amount of grass to eat?"

Question for Explanation

"How did you know this?"

Item No's 2 to 5

The same questions for judgment and explanation were asked after each transformation 1, 2, 3, 4 and 5. These transformations have been illustrated in figures 41, 42, 43 and 44.

Item No. 6

Transformation 6

In this transformation all the nine cubes of green sheet A were rearranged into 3x3 to make the shape of square.

The same questions for judgment and explanation were asked as in the case of transformation 1 (Fig. 45).

(b) Equality and Inequality tasks of Conservation of Area

(a) Equality tasks of Conservation of Area

Item No. 7

Materials

Two wooden square pieces exactly of equal size (each 7.5 cm. x 7.5 cm.) shape and colour. Square A was

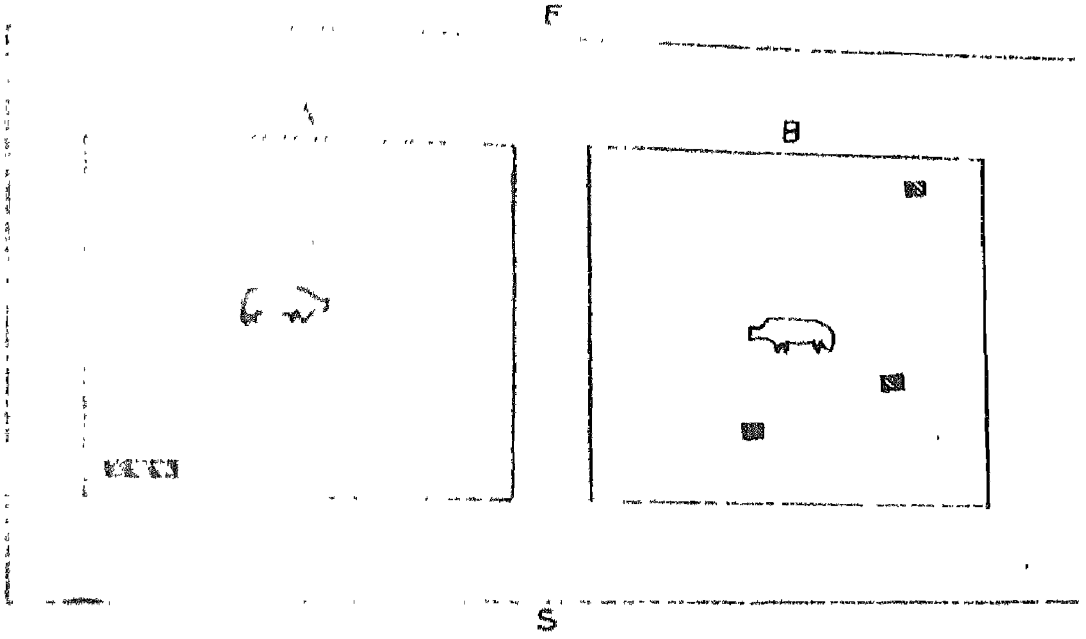


FIG 41 : POSITION OF OBJECTS IN ITEM NO. 2
(CONSERVATION OF AREA)

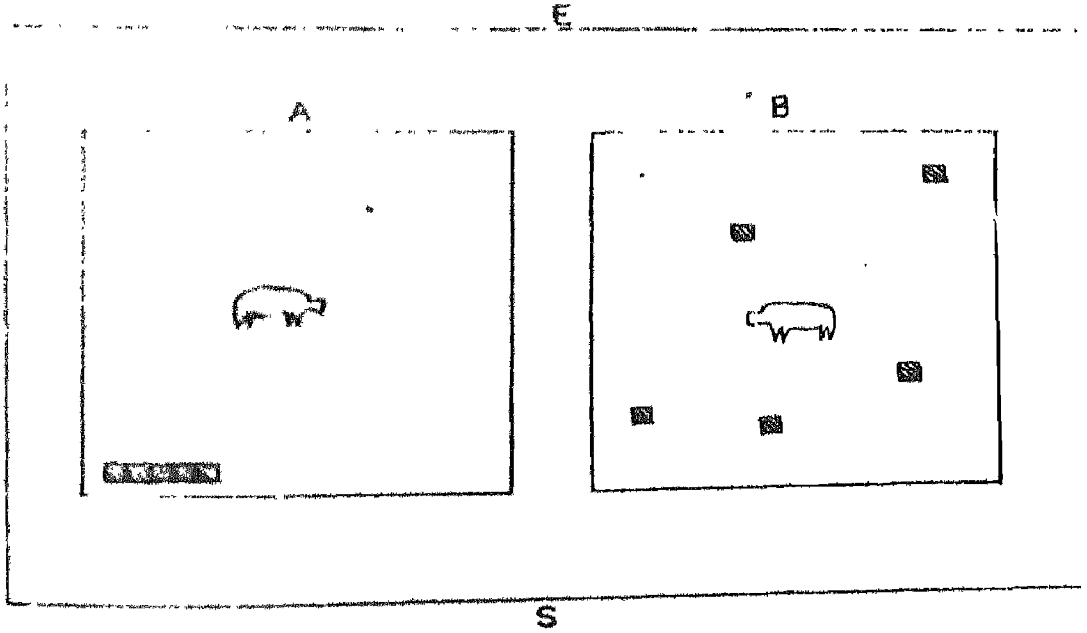
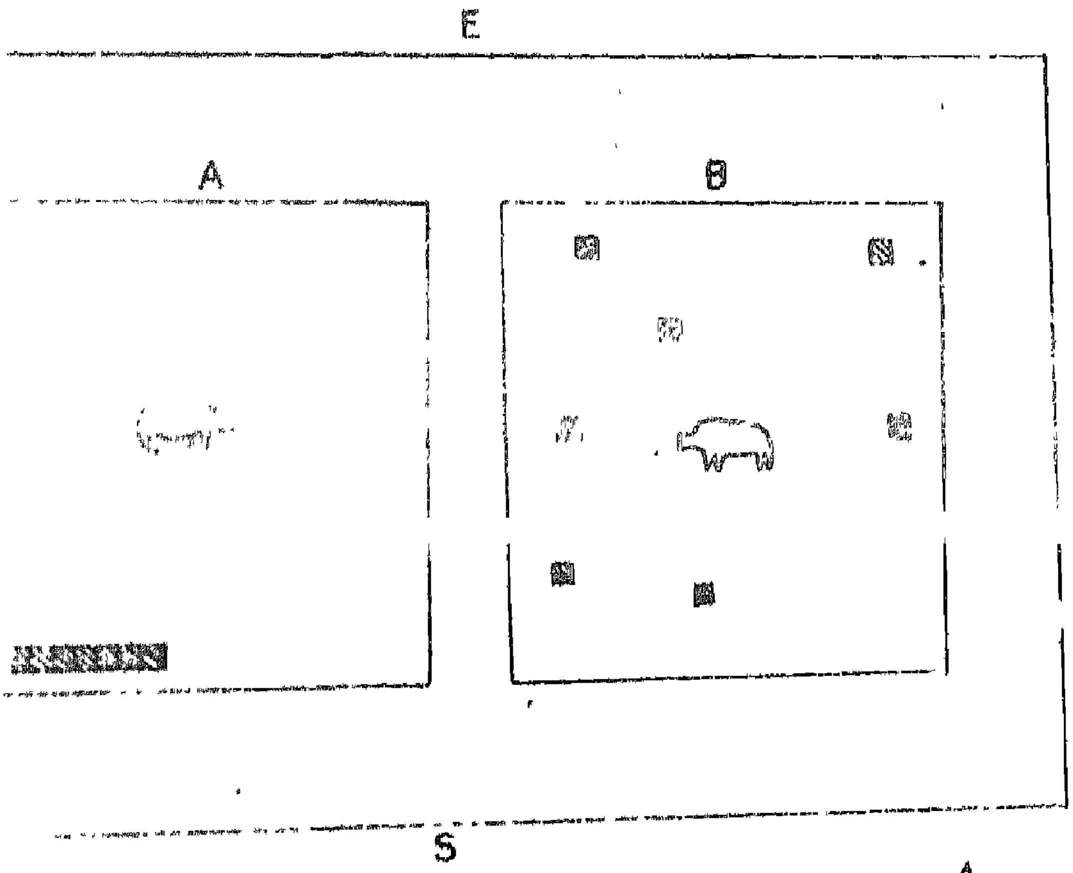
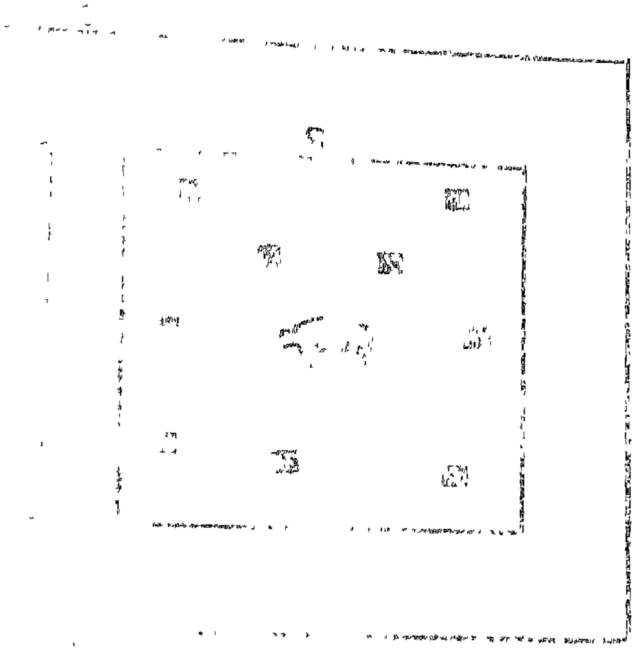


FIG. 42 : POSITION OF OBJECTS IN ITEM NO. 3
(CONSERVATION OF AREA)

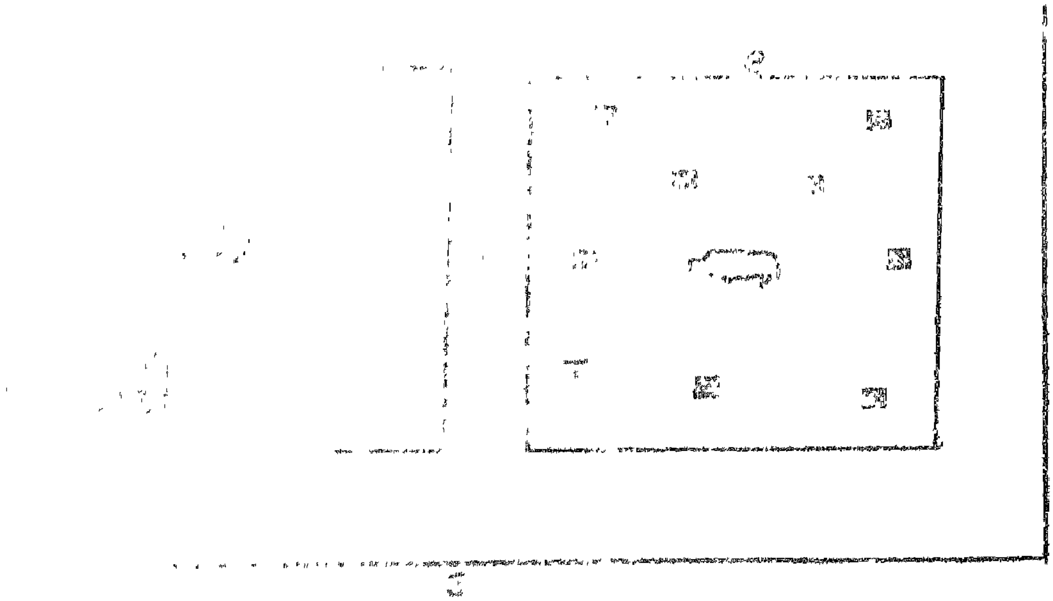


. 43 : POSITION OF OBJECTS IN ITEM NO. 4
(CONSERVATION OF AREA)



[illegible] ITEM NO. 5

[illegible]



[illegible] POSITION OF OBJECTS IN ITEM NO. 6
(CONSERVATION OF AREA)

a complete whole while square B was made up of a trapezium, a parallelogram, a triangle and a small square.

Position of Object Before Transformation:

Both the squares were placed on the table side by side* in front of the subject as shown in Fig. 46 a.

Transformation

Two of the pieces of square B (small square and triangle) were rearranged in the manner as illustrated in Fig. 46b.

Question for Judgment

"Now tell me are these two (pointing to square A and figure B) still equal in size or is any one of them smaller/greater than the other one?"

Question for Explanation

"How did you know this?"

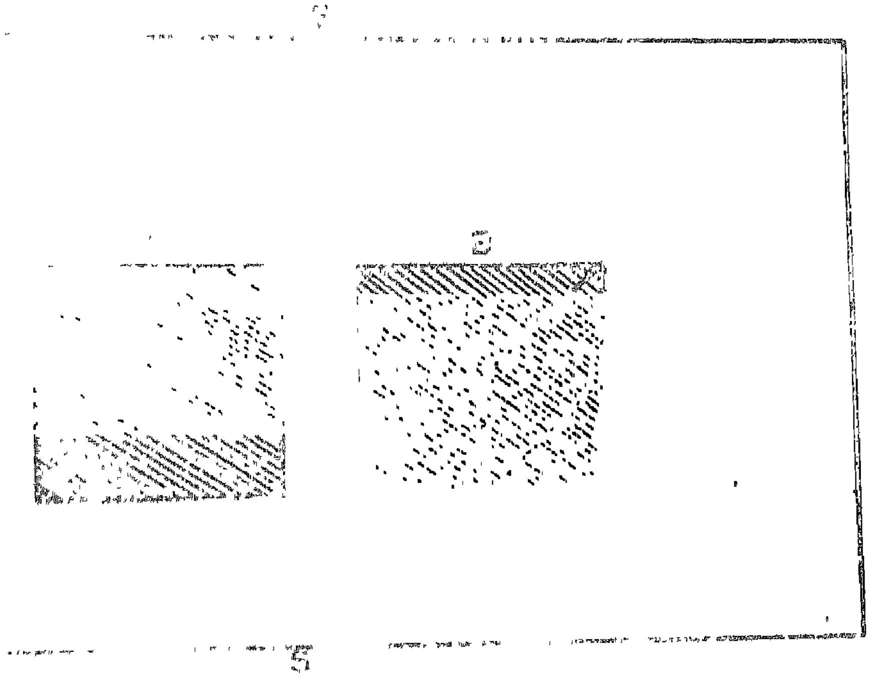
Item No. 8

Materials

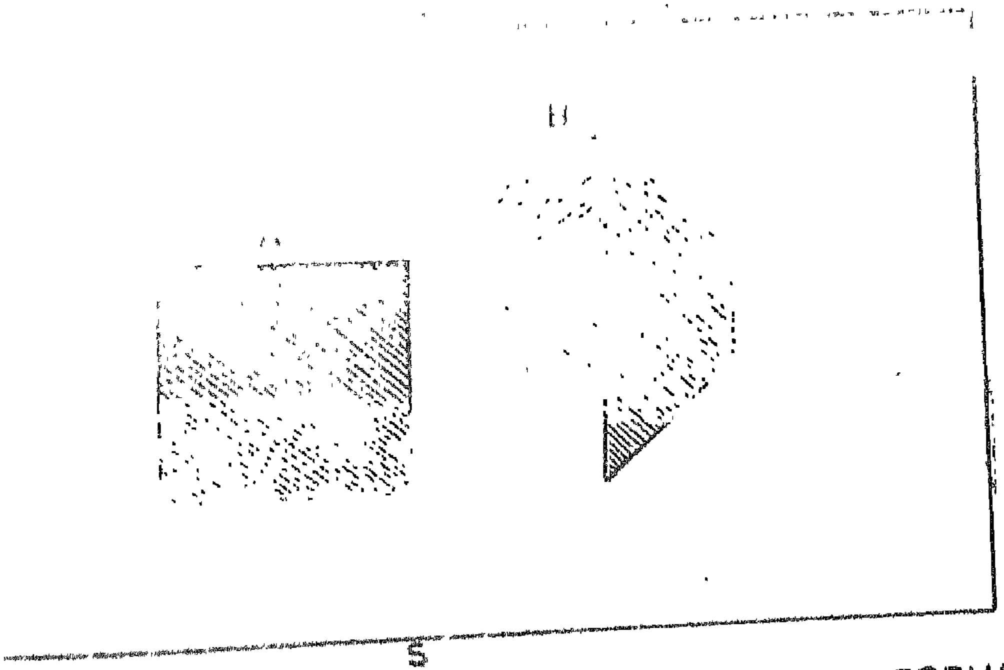
24 wooden squares identical in size (each 3.5 cm. x 3.5 cm.), shape and colour.

---

*If the child was not agree about the equality of the two squares, square A was superimpose over square B to show him that both are equal in size.



[illegible] OBJECTS BEFORE TRANSFORMATION IN ITEM [illegible] (CONSERVATION OF AREA).



40b : POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 7 (CONSERVATION OF AREA).

Position of Objects Before Transformation

First the subject was shown that all the 24 pieces were equal in size. With the help of 24 small square two rectangles A and B (each rectangle consisted of 2 x 6 = 12 unit squares) were constructed and placed side by side as shown in Fig. 47a. The subject was convinced about the equality of size of both the rectangles.

Transformation

The shape of rectangle B was changed by rearranging the 12 squares into 2 x 6 (Fig. 47b).

Question for Judgment

"Now tell me, are these two (pointing to rectangle A and B) are still of the same size or is any one of them greater/smaller than the other one?"

Question for Explanation

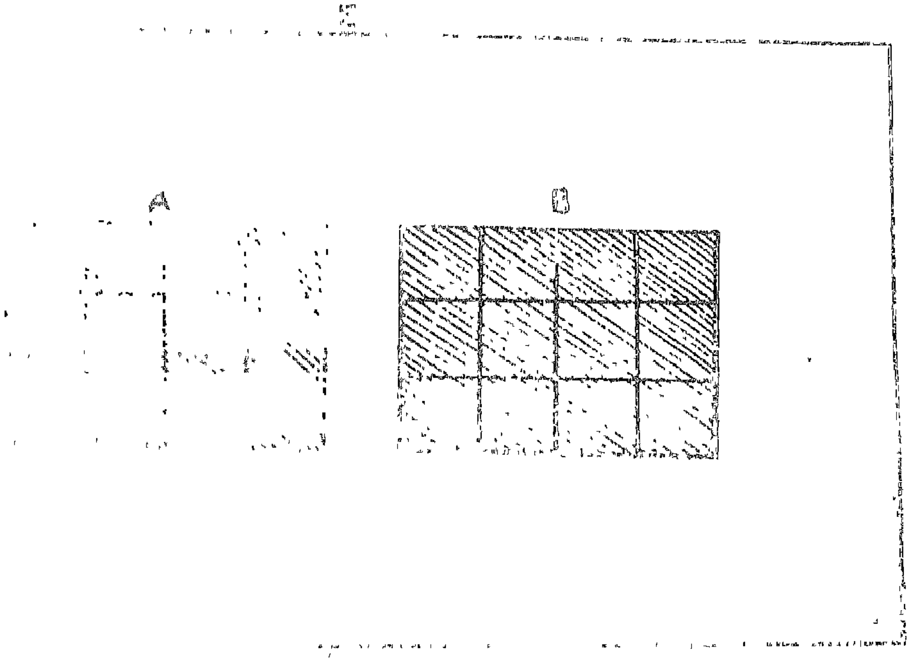
"How did you know this?"

(ii) Inequality tasks of Conservation of Area

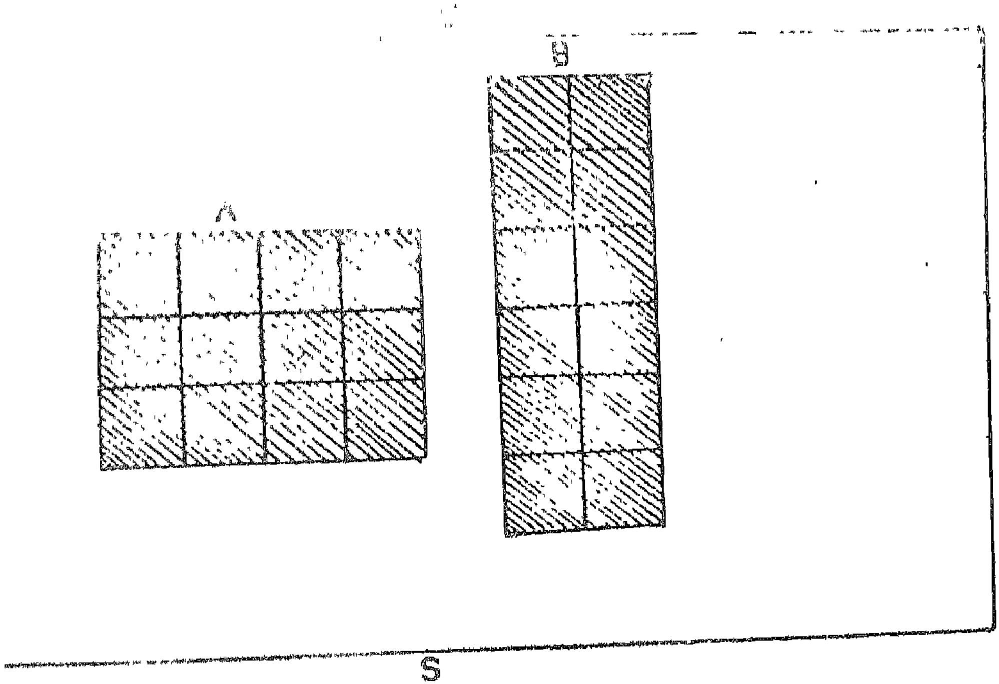
Item No. 9

Materials

Two inequal rectangles of card boards A and B. The sizes of rectangle A and rectangle B were 7.5 cm. x 10 cm. and 5 cm. x 10 cm., respectively. Rectangle A was



[illegible] BEFORE TRANSFORMATION (CONSERVATION OF AREA).



·47b: POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 8 (CONSERVATION OF AREA).

a complete whole while rectangle B was consisted of four triangles, equal in size, shape and colour.

Position of Objects Before Transformation

The two rectangles were placed side by side on the table before the subject (fig. 48a). The subject was convinced that both rectangles were not equal in size.*

Transformation:

The pieces of rectangle B were rearranged as shown in Fig. 48a.

Question for Judgment

"Now tell me, is there same amount of room on there (pointing to figure B) as there is on here (pointing to rectangle A) or is any of these having more/less amount of room on it than the other one**?"

Question for Explanation

"How did you know this?"

---

*If required inequality of the size of both the rectangles was also illustrated by superimposing rectangle A over rectangle B.

**If the child responded correctly to this question, he was further asked which of them was having more/less amount of room on it.

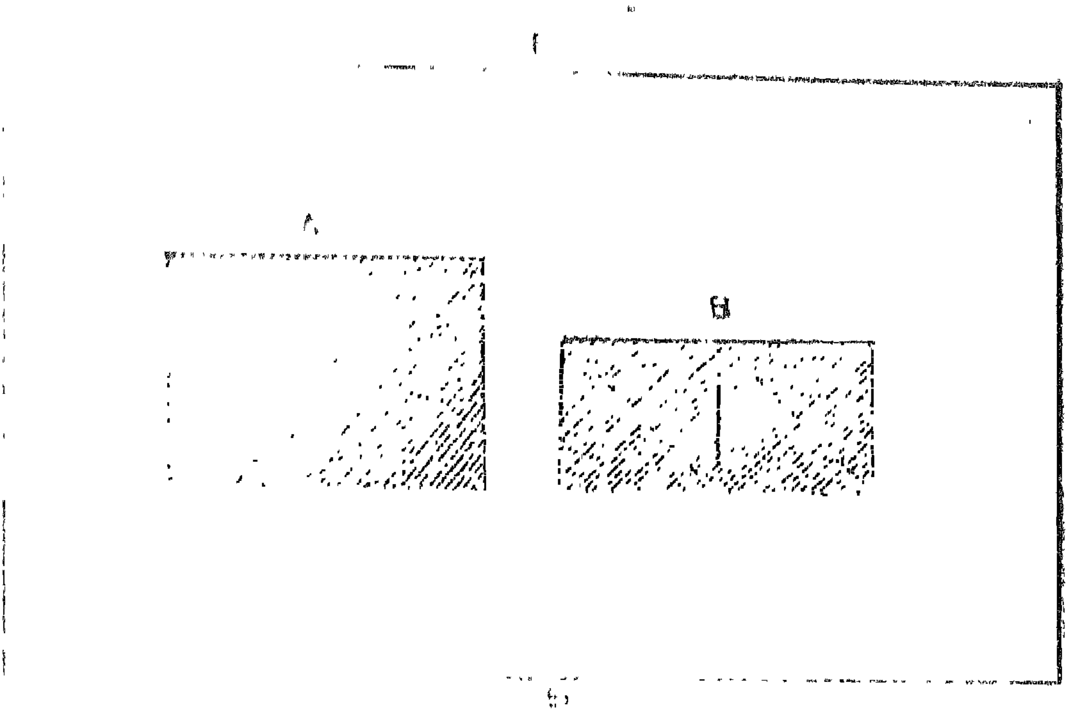


FIG. 48a. POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO. 9 (CONSERVATION OF AREA).

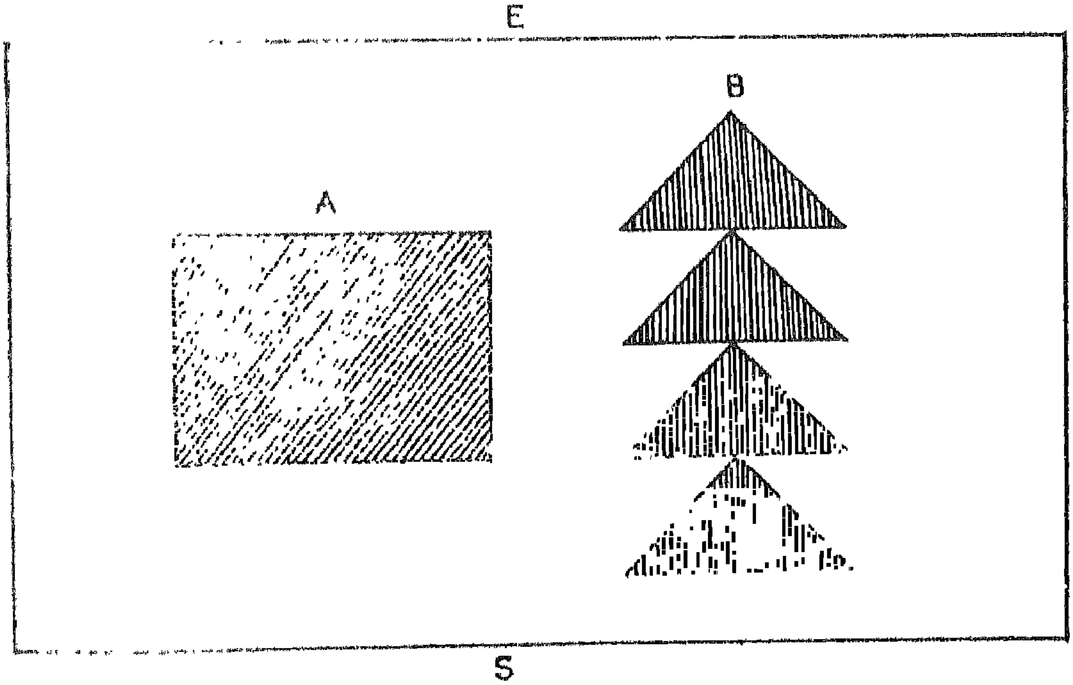


FIG. 48b. POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO. 9 (CONSERVATION OF AREA).

Item No. 10

Materials:

One wooden square (A) and one wooden rectangle (B). Square A was consisted of four rectangles. The size of each of these rectangles was 10.3 cm. x 2.7 cm. Rectangle B was also made up of four smaller rectangles. The size of each of these rectangles was 7.4 cm. x 2.7 cm.

Position of Objects Before Transformation:

In front of the subject, the square A and rectangle B was placed on the table as shown in Fig. 49a. The subject was convinced that the sizes of both were not equal.

Transformation

Two of the smaller rectangles of rectangle A were moved and rearranged as shown in Fig. 49b.

Question for Judgment

"Now tell me, are both these equal in size or is any of them larger/smaller than the other one?"

Question for Explanation

"How did you know this?"

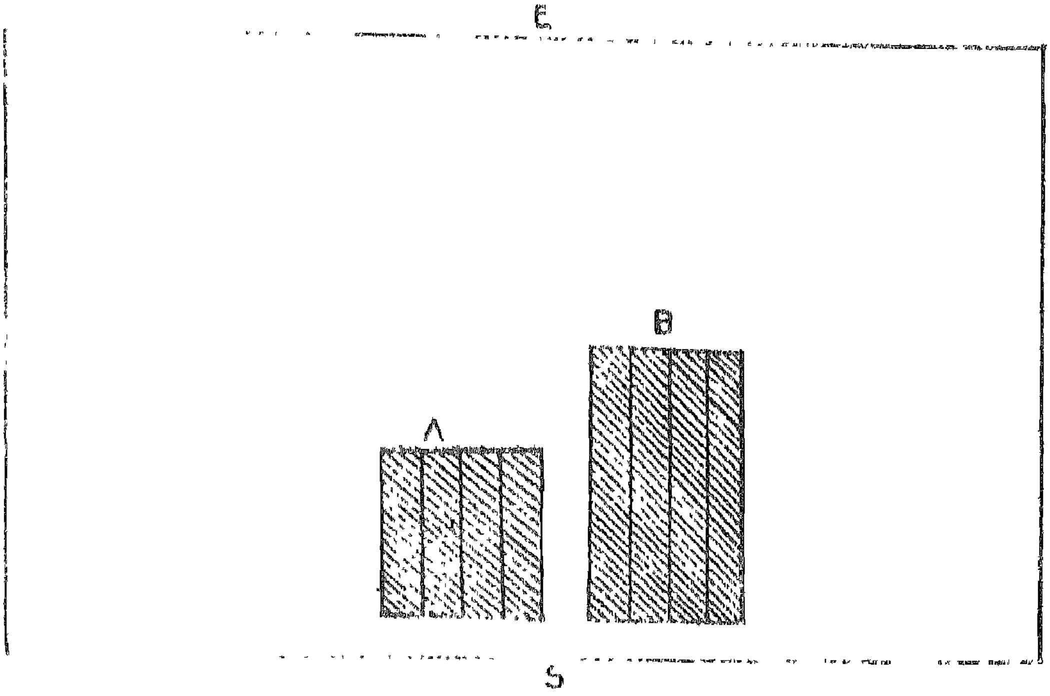


FIG. 49a : POSITION OF OBJECTS BEFORE TRANSFORMATION IN ITEM NO.10 (CONSERVATION OF AREA).

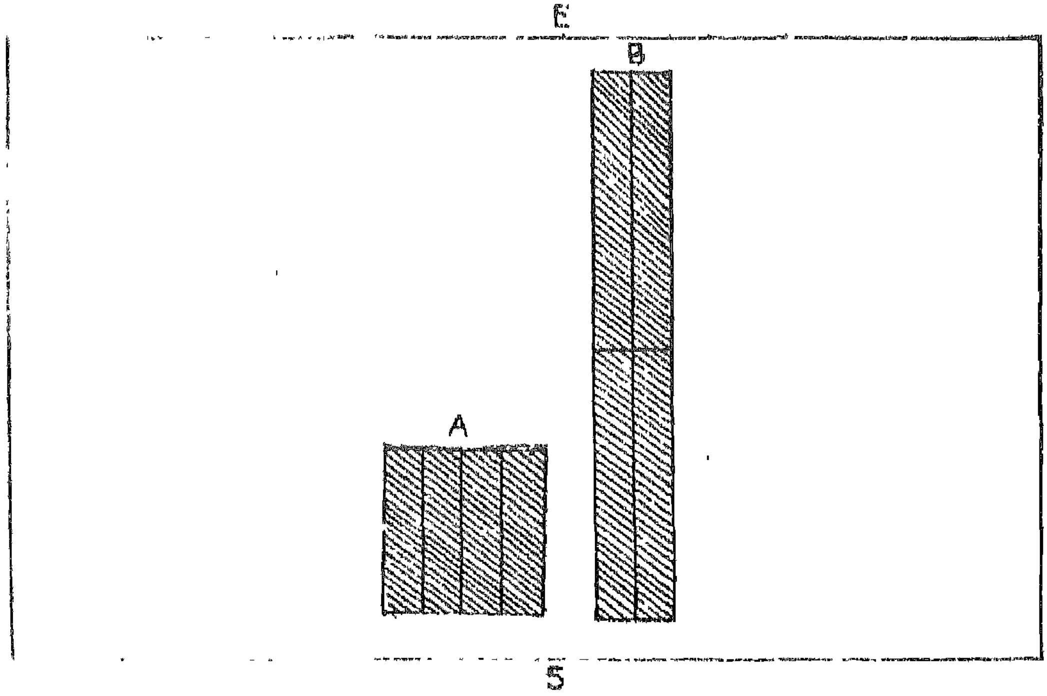


FIG. 49b : POSITION OF OBJECTS AFTER TRANSFORMATION IN ITEM NO.10 (CONSERVATION OF AREA).

TASK OF CONSERVATION OF AREA

(HINDI VERSION)

Conservation Tasks of Meadows of Piaget et al (1960)

Material and procedures used in these tasks have a already been discussed in the tasks of English Version. Here only general instruction and questions for judgment and explanation will be stated.

General Instructions to the Subjects

Pointing to green square squares the subject was told: "हम मान लेते है यह हरे रंग के बोर्ड घास के मैदान है। जैसा कि तुम्हे पहले दिखाया जा चुका है कि यह दोनो बोर्ड एक जितने आकार के है, अतः इन दोनों में एक जितनी घास होगी। यह गायें (showing the model of cows) है। इन्हें अपने-अपने मैदानों में एक जितनी घास खाने के लिये मिलेगी, क्योंकि यह दोनो मैदान आकार में एक बराबर है।

Showing the wooden cube the child was told: "देखो यह लकड़ी के चौकोर गुटके हैं, यह सभी एक जितने बराबर आकार में हैं। इन चौकोर गुटको को हम मान लेते है घर हैं। अब बताओ यदि एक घास के मैदान में एक घर बना दिया जाये तो उस मैदान में कुछ घास कम हो जायेगी या पहले जितनी ही रहेगी ?"

Item No. I

Transformation

After doing transformation as stated in the tasks of English Version, following questions for judgment and explanation were asked:

Question for Judgment

"अब तुम बताओ कि दोनों गायों
को अपने - अपने मैदानों में एक
जितनी घास खाने के लिये मिलेगी
या इनमें से किसी गाय को कम/ज्यादा
घास खाने को मिलेगी ?"

Question for Explanation

" यह तुमने कैसे जाना ?"

The same questions for judgment and explanation were asked in the case of transformation 2, 3, 4, 5 and 6.

(B) Equality and Inequality task of Conservation of Area

Materials and procedures used in these tasks have already been described in the English Version tasks. Following question for judgment and explanation were asked in Hindi.

Item No. 7

Question for Judgment

"अब तुम बताओ कि यह दोनों
(pointing to the figures A and B)
अब भी आकार में एक जितने
बराबर हैं या इनमें से कोई
छोटा/बड़ा है ?"

Question for Explanation

"यह तुमने कैसे जाना ?"

Item No. 9

Question for Judgment

"अब तुम बताओ कि उस पर
(pointing to the figure B) उतनी
ही जगह है जितनी की इस पर
(pointing to the rectangle A)
है या इनमें से किसी पर कम/ज्यादा
जगह है ?"

Question for Explanation

"यह तुमने कैसे जाना ?"

Similar question for judgment and explanation were asked in the case of item Nos. 8 and 10 also.

APPENDIX - VII

RECORD SHEET FOR THE TASK OF CONSERVATION

Name of the Subject ______________________________

Age ______________________________

Grade ______________________________

Name of the School ______________________________

Conservation of Length ______________________________

Item No. ______________________________

Judgment ______________________________

Explanation ______________________________

____

Item No. ______________________________

Judgment ______________________________

____

Explanation ______________________________

____

(In the same way other items together with judgment and explanation were written).

APPENDIX - VIIIa

SCORES OF TEST AND RE-TEST ON THE TASKS OF CONSERVATION OF LENGTH

Code No.	Test	Re-test
1	4	5
2	20	20
3	8	10
4	5	6
5	10	12
6	16	16
7	3	3
8	17	16
9	8	9
10	22	24
11	2	2
12	24	24
13	8	8
14	8	7
15	1	2
16	6	6
17	8	8
18	16	16
19	6	8
20	8	10
21	23	24
22	5	4
23	6	4
24	1	2
25	5	5
26	16	18
27	10	10
28	24	24
29	24	24
30	6	8

Rho Corrected for ties = .94

APPENDIX - VIIIb

SCORES OF TEST AND RE-TEST OF THE TASKS OF CONSERVATION OF AREA

Code No.	Test	Re-test
1	3	3
2	10	10
3	2	2
4	8	8
5	2	3
6	12	10
7	2	2
8	11	12
9	2	2
10	20	22
11	3	3
12	24	24
13	8	9
14	3	3
15	1	2
16	3	3
17	3	4
18	9	11
19	10	10
20	10	12
21	16	16
22	2	2
23	2	2
24	2	3
25	5	3
26	15	14
27	4	4
28	14	14
29	23	24
30	1	1

Rho corrected for ties = .91

APPENDIX - IXa

TWO SETS OF SCORES ASSIGNED BY TWO JUDGES ON THE TASKS OF CONSERVATION OF LENGTH

Case No.	Test	Re-Test
1	4	4
2	20	20
3	8	7
4	5	6
5	10	10
6	16	16
7	3	2
8	17	20
9	8	7
10	22	23
11	2	2
12	24	24
13	8	10
14	8	8
15	1	1
16	6	5
17	8	8
18	16	16
19	6	6
20	8	8
21	23	20
22	5	6
23	6	6
24	1	1
25	5	4
26	16	16
27	10	10
28	24	24
29	24	24
30	6	6

Rho corrected for ties = .97

APPENDIX - IXb

TWO SETS OF SCORES ASSIGNED BY TWO JUDGES OF THE TASK OF CONSERVATION OF AREA

Code No.	Judge I	Judge II
1	3	2
2	10	12
3	2	2
4	8	8
5	2	2
6	12	12
7	2	2
8	11	10
9	2	2
10	20	20
11	3	3
12	24	24
13	8	8
14	3	4
15	1	1
16	3	3
17	3	3
18	9	8
19	10	10
20	10	11
21	16	16
22	2	2
23	2	3
24	2	2
25	5	4
26	15	16
27	4	4
28	14	16
29	23	24
30	1	1

Rho corrected for ties = .94

APPENDIX - X.

Scores on the Test of Intelligence, Tasks of Spatial Egocentrism Conservation of Length and Conservation of Area of 280 Subject.

Subj. No.	Scores on the Test of Intell.	Socres on the Tasks of Spat. Egost.	Scores on Tasks of Conserv. of Length	Scores on the Tasks of Conserv. of Area
1	2	3	4	5
1	20	24	24	24
2	27	20	19	17
3	21	10	12	11
4	26	30	22	22
5	27	5	6	0
6	20	0	3	0
7	28	16	16	12
8	21	36	23	22
9	25	19	21	17
10	20	0	0	2
11	23	10	16	18
12	23	13	9	10
13	19	18	7	0
14	26	29	18	20
15	20	10	17	10
16	26	13	13	10
17	24	21	18	18

Contd.......

1	2	3	4	5
18	25	15	14	16
19	24	25	24	24
20	26	24	16	21
21	24	11	6	2
22	25	20	15	16
23	23	6	4	2
24	26	8	4	4
25	24	18	16	12
26	14	6	2	0
27	26	20	16	18
28	24	16	10	14
29	21	8	0	0
30	21	36	24	24
31	23	15	10	14
32	27	13	8	8
33	15	11	4	0
34	17	15	12	10
35	23	6	0	0
36	24	6	4	8
37	26	8	8	0
38	20	19	21	20
39	13	14	23	15
40	13	9	0	0
41	18	13	4	6
42	20	11	13	4
43	11	8	0	8
44	24	12	13	14
45	11	12	1	0
46	24	11	4	4
47	23	4	21	20

Contd......

1	2	3	4	5
48	25	15	17	17
49	23	19	18	18
50	20	16	14	10
51	12	5	2	0
52	18	0	4	2
53	23	13	5	6
54	26	27	24	24
55	18	8	1	2
56	20	27	24	12
57	14	19	5	0
58	25	16	13	14
59	21	16	14	10
60	24	15	10	10
61	18	5	5	2
62	9	6	0	0
63	17	17	12	8
64	23	19	17	22
65	12	8	2	0
66	11	8	3	0
67	22	13	12	12
68	17	5	1	5
69	27	21	24	23
70	17	6	1	5
71	23	17	16	14
72	24	17	16	16
73	17	20	19	20
74	24	22	20	24
75	15	10	2	1
76	23	17	16	16
77	12	15	12	10
78	13	17	16	14
79	23	7	0	0
80	15	12	10	1

Contd..........

1	2	3	4	5
81	24	27	19	20
82	25	12	4	0
83	21	24	18	20
84	21	17	16	16
85	23	0	13	8
86	24	20	16	16
87	17	14	13	11
88	25	20	20	17
89	20	23	23	18
90	23	22	19	20
91	23	12	0	24
92	17	6	0	0
93	25	20	19	21
94	28	19	16	20
95	23	20	21	22
96	24	17	16	14
97	20	24	22	20
98	18	6	0	0
99	19	7	0	0
100	13	5	0	0
101	18	10	0	8
102	18	6	0	0
103	19	25	22	21
104	15	28	2	0
105	17	8	24	23
106	12	4	0	0
107	21	16	14	10
108	10	5	0	0
109	15	15	12	11
110	16	16	10	8
111	15	4	6	0

Contd.......

1	2	3	4	5
112	20	22	17	24
113	14	7	0	0
114	20	17	6	3
115	13	17	14	17
116	13	17	18	18
117	14	6	9	0
118	15	20	19	20
119	13	10	4	6
120	18	11	8	6
121	21	32	24	24
122	15	20	19	18
123	16	11	9	2
124	15	18	8	3
125	15	18	20	20
126	15	12	7	5
127	23	17	16	8
128	8	10	2	0
129	22	10	20	18
130	19	10	8	10
131	18	21	19	17
132	20	7	0	0
133	18	10	8	0
134	14	12	2	0
135	20	22	16	16
136	20	11	0	0
137	19	5	0	0
138	19	8	4	0
139	20	21	16	8
140	20	9	3	0
141	16	19	14	15
142	14	13	12	8

Contd......

1	2	3	4	5
143	15	4	0	0
144	16	17	16	16
145	18	10	0	0
146	20	12	11	0
147	21	21	16	14
148	27	5	0	0
149	19	10	0	0
150	11	8	0	6
151	18	8	0	4
152	11	6	4	0
153	15	8	7	0
154	20	15	10	16
155	11	21	16	16
156	17	11	8	0
157	13	10	2	0
158	15	12	8	10
159	10	8	6	4
160	19	7	4	15
161	16	16	5	0
162	20	20	23	21
163	19	8	16	10
164	20	3	0	8
165	21	13	5	4
166	19	9	0	0
167	12	8	0	0
168	2	7	6	0
169	17	20	16	16
170	22	9	0	0
171	14	19	15	14
172	2	20	4	8
173	12	5	0	0

Contd........

1	2	3	4	5
174	10	9	1	0
175	20	15	12	16
176	10	0	0	0
177	15	8	20	16
178	20	11	16	16
179	15	0	0	0
180	15	8	0	0
181	13	9	19	16
182	17	12	10	13
183	15	8	3	0
184	10	12	8	10
185	3	19	4	0
186	14	19	16	16
187	13	20	16	18
188	19	17	16	8
189	14	15	13	8
190	10	21	16	15
191	15	25	20	20
192	17	12	8	3
193	9	10	8	8
194	18	11	0	0
195	20	20	12	18
196	21	8	0	8
197	13	16	14	15
198	21	6	3	7
199	16	10	16	14
200	13	13	17	4
201	17	9	16	3
202	19	7	0	0
203	16	8	9	10

Contd.........

1	2	3	4	5
204	15	11	5	16
205	10	13	4	16
206	20	19	16	16
207	21	8	16	16
208	14	11	8	8
209	16	8	1	0
210	11	3	8	0
211	8	7	4	0
212	15	20	18	18
213	20	18	20	16
214	15	18	10	16
215	19	8	8	12
216	18	20	16	10
217	16	13	16	0
218	14	11	10	0
219	13	6	2	0
220	15	29	23	21
221	16	9	2	2
222	4	6	0	0
223	13	14	16	12
224	12	8	5	0
225	16	13	15	12
226	14	24	20	22
227	17	16	8	8
228	14	4	0	0
229	18	11	9	12
230	16	8	0	0
231	15	21	15	13
232	21	9	0	0
233	13	7	0	0

Contd..........

2	3	4	5
29	13	9	6
21	19	16	16
28	20	20	21
26	16	13	16
25	13	12	10
34	31	24	24
30	34	24	24
26	15	16	16
15	4	8	0
33	33	24	24
20	8	2	2
28	21	15	20
23	13	6	8
36	36	24	24
32	11	16	16
30	26	24	24
36	20	18	17
29	30	22	20
28	18	17	16
26	19	5	16
17	27	24	22
20	14	10	12
31	27	23	18
30	23	20	22
20	6	4	0
30	18	16	16
28	7	16	16
29	28	24	22
17	13	6	0

Contd....

1	2	3	4	5
263	32	20	12	14
264	30	28	23	24
265	30	27	23	22
266	31	19	14	15
267	33	32	24	24
268	30	20	15	14
269	30	11	9	5
270	31	33	24	24
271	32	31	24	24
272	31	12	12	14
273	29	11	2	2
274	26	23	16	22
275	8	13	3	5
276	3	16	8	6
277	28	14	10	14
278	21	26	23	24
279	4	2	5	3
280	13	23	3	0